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THE PLANTAR FASCIA:
A STUDY OF ITS ANATOMY AND OF ITS PATHOLOGY IN TALIPES CAVUS;
A NEW OPERATION FOR ITS CORRECTION*

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"WHAT is new is not true and what is true is not new" is an old saying which if literally correct, would practically preclude progress along all lines. Fundamental principles were long ago recognized and recorded by the pioneers in all branches of science and art and in so far as the above epigram concerns these, it is largely correct. However, new applications of these principles occur every day in all professions and especially in the art and science of medicine and surgery. We speak of the classical symptoms and signs of inflammation, disease, direct injury, etc., and find they have remained the same since the earliest observations were made concerning them, but the variations of their application under climatic, geographical, occupational and other limiting and altering influences of modern life are ever changing and really new. For over a century, the plantar fascia has been recognized as an extremely important factor in the development and maintenance of foot deformities, especially those of talipes cavus and varus, though whether as a primary or secondary agent has always been an unsettled question. Practically all writers on the subject of hollow-foot, cavus and claw-foot agree that a greater or lesser degree of infantile paralysis is the most common underlying factor in the production of the deformity and that certain muscles or groups of muscles on the anterior surface of the leg and the interossei and lumbricales of the foot are the ones chiefly involved in the more severe form, viz., claw-foot.

A distinction should be made between claw-foot, which is the extreme type of pes cavus, and pes arcuatus, the early and therefore a mild form of the deformity. The present paper deals only with the milder forms, which are by far the most common types.

Walsham and Hughes[1] quote Redard to the effect that "the congenital type of cavus may be due to a primitive malformation of the ligaments and bones of the tarsus." Also that the acquired type "is attributed by Duchenne to paralysis of the inter-osseous and lumbrical muscles and the short flexors and abductor of the great toe." These authors believe that "the interossei and lumbricales normally dorsi-flex the toes at the first interphalangeal joint and at the same time plantar-

[1] Walsham, W. J., and Hughes, W. K. The Deformities of the Human Foot, with Their Treatment. N. Y., 1895.

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flex the toes at the metatarso-phalangeal joint. When these muscles are weakened or paralyzed, their opponents, the long flexors and extensors, throw the toes into the clawed position by plantar flexion at the inter-phalangeal joint and dorsal flexion at the metatarso-phalangeal joint" but they cite four facts against the paralytic involvement of the interossei and lumbricales in these cases:

1. In some cases noted by them, the interossei act well.

2. While these muscles may contract only mildly at first, after corrections of these deformities, they become stronger and stronger, showing that their weakness was due apparently to the opposing force in the sole.

3. These muscles are supplied by the same nerve as supplies the posterior muscles of the leg and would therefore be unlikely to be involved with the anterior muscles. Furthermore that in the event of paralysis, they would scarcely be selected alone among all the muscles supplied by the posterior tibial nerve.

4. The feebleness of interosseus contraction, as compared with that of the long muscles of the foot, is scarcely a factor in the prevention of more frequent formation of this deformity.

Golding-Bird[1] considers that the condition often follows paralysis of the peroneal muscles. This enables the adductors to draw the front of the foot downward and inward and thus permits secondary contraction of the fascia to occur quickly.

Keetley[2] believes cavus arises from trophic changes in the plantar structures, secondary to loss of power in the dorsal flexors of the toes and forefoot, and cites as a parallel or similar condition the changes in the facial structures following paralysis of the facial nerves.

Whitman[3] says a mild form of infantile paralysis or neuritis in early childhood, causing a temporary weakness of the anterior muscles of the leg and thus a toe-drop, is "followed by a secondary contraction of the tissues of the sole and of the muscles of the calf." Some acute infectious process may cause foot or leg weakness which does not become apparent until adult life, when greater strain and weight occur, or it may be caused by gout, neuritis, rheumatism or some form of traumatism to the foot.

Jones and Lovett[4] look upon the condition as due either to the effects of gravity in a paralyzed part or the action of unopposed muscles pulling the two parts of the foot together.

G. G. Davis,[5] in an article on the "Treatment of Hollow-Foot," divided the cases into two great classes, the paralytic and non-paralytic. In each class, the pathology is but poorly understood and obscure.

Of the non-paralytic form, he says that the cause is to be looked for in some irritative factor, probably unsuitable footwear and strain due to excessive use or unsuitable habits or occupation. The condition present certainly consists of a more or less permanent irritation, spasm or contraction of the muscles. As the flexors are stronger than the extensors, we find the foot assuming a position of plantar flexion, also an increase of the plantar arch. He thus looks upon the deformity as primarily muscular and any other changes as purely secondary.

Of the paralytic he says: "The contractions which are present are not active contractions such as we have seen to be characteristic of the irritative or non-paralytic form, but they are passive contractions subsequent on malposition and disuse."

Cochrane[6] considers all types of hollow foot or cavus as different degrees of one

[1] Golding-Bird, C. H. Pes valgus acquisitus. Pes pronatus acquisitus. Pes cavus. *Guy's Hosp. Rep.*, Lond., 1883, 3 s., xxvi, 439.

[2] Keetley, C. B. Orthopaedic Surgery; a Handbook. Lond., 1900.

[3] Whitman, R. A. Treatise on Orthopaedic Surgery. Ed. 7, Phila., 1923.

[4] Jones, R., and Lovett, R. W. Orthopedic Surgery. N. Y., 1923.

[5] Davis, G. G. Treatment of hollow-foot (pes cavus). *Am. J. Orthop. Surg.*, 1913, xi, 231.

[6] Cochrane, W. A. Orthopedic Surgery. N. Y., 1926.

great class. The causes are muscular imbalance with shortening of the structures on the stronger side (sole). Some are also due to disturbance of innervation as in spina bifida (either patent or occult); others arise from muscle weakness of infantile paralysis or disease of the nerve trunks supplying the dorsal muscles of the foot and leg.

In addition to the above cited causes, Tubby[1] mentions:

1. Multiple neuritis following measles, scarlet fever, cholera and during dentition.
2. Exaggerated action of the peroneus longus.
3. Rheumatism in children and adults, or in those whose parents have suffered from that affection.
4. Too short boots worn by children or young adults.
5. In women, boots too small and with high heels.

Nicoladoni, cited by Walsham and Hughes, "considers that in the presence of paralysis, the plantar muscles were the great factor in drawing the ball and heel of the foot together."

In 1919, my attention became centered upon the plantar fascia as a direct factor in the etiology of these cases through a case reported before the American Orthopedic Association in Rochester, N. Y., and published in the *Transactions* as "A New Method of Correction of Varus and Cavus in Club-Feet." The case reported was a recurrence of the cavus and varus following an old Phelps' operation for congenital equinovarus and the condition was finally cured by removal of the scar and transplantation of a flap of skin, fat and fascia from the calf of the opposite leg. Keetley in 1889 (British Medical Association) described a similar procedure for the same deformity, but turned down a flap from the redundant skin on the dorsum of the foot. The operation was rediscovered in 1895 by T. H. Kellock[2] and again by Mr. Muirhead Little, and then promptly forgotten by the profession. In 1913, in the London Hospital, I watched Mr. Openshaw remove a very extensive scar from the sole of the foot of a twelve-year-old girl for the relief of a relapsed varus and cavus in congenital clubfoot. Correction was obtained immediately in spite of the fact that the plantar fascia had been removed by another surgeon two years previously for the same condition, but the resultant scar had quickly contracted and the deformity recurred. When I asked Mr. Openshaw what was to prevent the scar from again contracting, he admitted he did not know.

A careful study of these deformities after my operative experience with the Phelps' case showed that they vary greatly both as to degree of contracture and as to the structures involved. In some cases, one finds no evidence of contracture except in the plantar fascia. This is verified by the complete correction of the deformity following thorough wrenching after section of the fascia near its origin. Relapse, however, will take place in these cases if the stretching is not maintained and proper attention is not given to the fitting of the shoes.

Other cases show contracture of the skin as well as the fascia and in these the skin presents a greater obstacle to correction than does the fascia. Such a type is best corrected by a Phelps' incision with a transplant into the cut as reported by Keetley and others or as described by me.

A third type develops contracture of the plantar fascia, skin and subtarsal ligaments. With this type, which is really a more advanced form of the others (as Cochrane has indicated), there is also likely to be found shortening of the plantar flexor muscles which may be due to some inherent changes in the muscle fibers, though more probably it is located in the fascia of the septa and the connective tissue of the muscles themselves. To this type may be gradually added a fourth in which are found changes in the

[1] Tubby, A. H. Deformities, including Diseases of the Bones and Joints. Ed. 2, Lond., 1912.

[2] Kellock, T. H. A modification of Phelps' operation for the relief of talipes equino-varus. *Lancet*, 1895, *i*, 805.

tarsal bones and their articulations. This form is the true claw-foot and practically all structures are involved in the primary or secondary changes incident to, or causative of the deformity. One naturally sees many more cases of the first and second types than of the third and fourth and the investigation of quite a number of the first degree cases led to a careful study of the plantar fascia to learn why the correction of this deformity is attended with so great difficulty and so many ultimate failures.

Fig. 1. Common type of pes cavus or hollow-foot.

ANATOMY OF THE FASCIA

The plantar fascia arises by a broad attachment from the tubercle on the under side of the os calcis and extends forward in the sole to spread out widely and ultimately to lose itself in the deep fascia of the foot and also to send processes to the heads of the metatarsals. Between these processes run the tendons of the plantar flexors of the toes. At about the junction of the posterior and middle thirds, a branch goes off from the inner and upper edge of the fascia and promptly splits into two parts. One of these, of varying breadth and thickness, runs closely under the skin upward toward the front of the ankle joint and there becomes merged with a similar branch from the annular ligament of the ankle joint. From its anterior edge also, just below and in front of the internal malleolus, arises a broad attachment of the adductor hallucis muscle. The other division of the branch runs directly upward into the foot and is inserted into the astragaloscaphoid ligament. The intimate relationship of both these slips with the various fasciae of the foot and tendon sheaths on the inner side, makes them most important factors in the shortening on the inner side commonly associated with that in the sole. On the top of the fascia lie the flexor brevis muscles, but except in the posterior portion of the fascia there exists no intimate attachment between the two. (Fig. 2.)

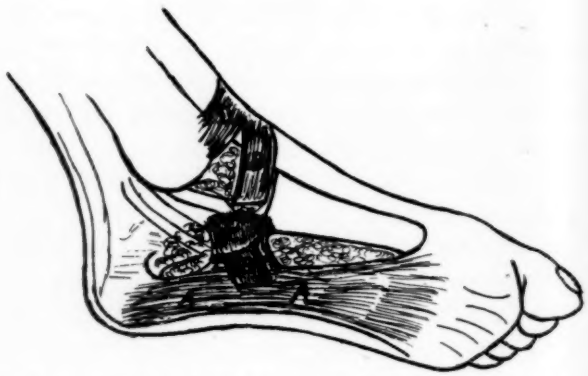

Fig. 2. A. Main body of fascia. B. Branch to annular ligament. C. Branch to astragalo-scaphoid ligament. D. Annular ligament.

After the fascia is uncovered in the operation to be described later, one may find a variety of changes present. There is always shortening and there is also some thickening. The thickening may be uniform throughout the entire fascia or it may be limited to the outer, middle or inner portions. This is very evident to the eye and according to whether it lies on the inner or the outer portion, the foot will tend to turn in that direction; thus it is apt to prove a determining factor in lateral deviation as well as in shortening of the foot. In practically all cases of the milder form of contracture, after the fascia was removed, the brevis muscles were found

unchanged and the deformity was easily corrected. The question then arose why the fascia should show shortening and the muscles escape if the changes were, as commonly ascribed, secondary to the effects of gravity and the disturbance of muscle balance following infantile paralysis or some congenital interference with, or degenerative loss of nerve function. Accordingly, every fascia removed in a group of 15 cases operated upon was sent to the laboratory for study. These examinations

Fig. 3. Incision to expose fascia.

were made in four different laboratories and by different pathologists, but in every case the same report was received, namely, that the tissue showed chronic inflammatory changes of infiltrative type and the picture was that of a typical fibrositis. All parts of the fascia showed this change, but in the thickened portions it was more dense than in the thinner. Thus was given the explanation of the fascial contraction in these cases, making it a primary instead of a secondary factor.

In the endeavor to explain the cause of the fibrositis, a number of conditions offered. Trauma has been mentioned as a factor and while this is admitted in Dupuytren's contraction of the palmar fascia, there is no history of injury in the plantar type of contracture except as will be mentioned later. The common and widespread use of metal arch supports, variously fitted as they are, should be frequently followed by irritation and contraction of the plantar fascia, but it seems never to have been observed, in fact many orthopedic surgeons claim that the pressure of the plate tends more to thin by absorption than to thicken the fascia. Gout and rheumatism are also mentioned as etiological factors, but these conditions are extremely uncommon at the age when the hollow-foot is most common and at which it begins. One must admit, how-

Fig. 4. Fascia exposed.

ever, the possible irritative influence of poisons on tissues, since in Dupuytren's contraction, which is a condition of later life, there is commonly a history of some metabolic disturbance of major or minor character in addition to the trauma of function. Practically all writers agree that infantile paralysis of a mild or abortive type is a factor in the causation of this condition and when one thinks of the widespread involvement of tissues in some of these cases and how early and rapidly contraction takes place in those where the infection is severe, one can readily conceive that the degenerative changes in connective and similar tissues may arise from the action of the infec-

tion, whether toxic or bacterial, and regard it as a possible and even a probable cause. Added to this factor may also be the element of trauma from strain on the fascia, where walking and function are resumed soon after the attack.

The possible influence of ischemia, whether through direct interference with the blood supply or through nerve injury (as in Volkmann's contracture) is also to be thought of, but the fact that in none of my cases did the short muscles in

Fig. 5. Fascia removed.

the sole show changes renders this condition of but little importance as a causative factor. Whether the examination of the dense tissues or fasciae in other parts of the body in these cases would show evidences of fibrositis, I do not know, but the constant findings in the cases examined are fairly conclusive of a direct relationship between the new tissue formation and the resultant deformity. The paralysis or weakening of the dorsal muscles may and doubtless does aid the progress of the change, even as faulty shoes, faulty walking and other factors cause deformities, but they are adjuvant rather than causative factors. We not infrequently see cases as cited by Walsham and Hughes in which the dorsal muscles are quite normal in strength but plantar shortening progresses steadily and with it deformity of the toes and tarsal bones.

In reading the directions for treatment given by various writers, one might readily get the impression that the condition was an easy one to overcome, though in a discussion of the condition at a recent meeting of the American Orthopedic Association, all the speakers agreed that treatment was extremely unsatisfactory. Many

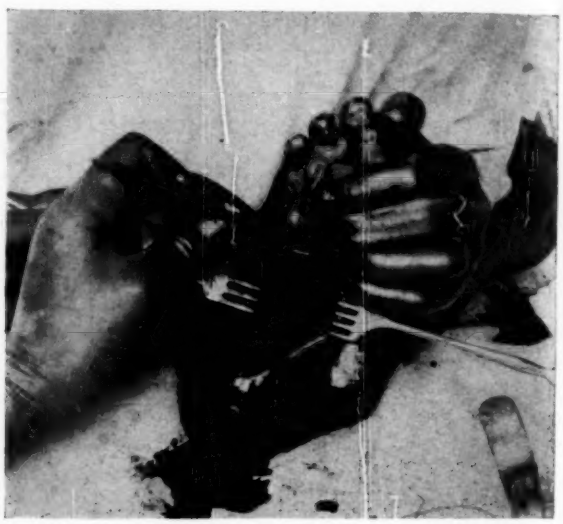

Fig. 6. Fat transplant from side of thigh sewn in place.

different operations have been brought forward for the relief of the hollow-foot and some surgeons claim to be able to cure the earlier cases by means of a steel plate having a transverse elevation on the anterior end to cause the ball of the foot to slide forward in walking and thus promote the stretching of the fascia. One can but wonder what fixes the heel to prevent it from being pulled forward by the muscles and fascia of the sole. It will not be necessary to review the various operative procedures here as they are familiar to the orthopedic surgeon and, as in the case of remedies for rheumatism, the great number indicates that there is no specific and unfailing one.

OPERATION

The operation which I wish to describe is founded upon the pathological condi-

tion which underlies the deformity. The contraction of the fascia follows the cellular infiltration plus opposing muscle weakness and faulty position, and so long as this altered tissue is present, the tendency to contraction is constant, even as in any scar tissue which is not kept persistently stretched. If section of the fascia is done, more scar is formed and further contraction occurs. The operative indication is to interrupt the vicious line of contraction by interposing a tissue that will not contract and this is accomplished as follows:

The densest line of contraction in the plantar fascia is easily located by the fingers when the ball of the foot is pressed in dorsiflexion. A longitudinal incision is then made through the skin over this line, from near the posterior attachment to the ball of the foot. The skin and superficial fascia are separated on both sides and the fascia freely uncovered. (Figs. 3 and 4.) This dissection runs well up along the inner side of the foot near the internal malleolus. The fascia is then cut off at both ends and dissected from the muscles beneath. The branch running upward to join the annular ligament is then followed as high as possible and cut off from its attachments. The portion running up under the foot to join the astragaloscaphoid ligament is next followed and cut off from that structure. (Fig. 5.) Pressure is then made under the ball of the foot and the foot may be straightened. If this is not possible, the astragaloscaphoid or deep plantar ligaments may be found shortened and these should be cut or loosed with a periosteal elevator. In most cases this permits correction of the deformity with ease. The wound is packed with gauze and an incision is then made on the outer side of the thigh or the calf of the leg and a flap of fat more or less triangular in shape and large enough completely to cover the denuded area is dissected off. This flap is then spread out in the denuded area in the foot (Fig. 6) and four sutures are used to keep the flap in place, one in the anterior end, one on the outer side and one in the posterior end, while the fourth is passed through the skin at the highest point of dissection on the inner side of the foot, through the flap and out again through the skin, and is tied over a pledget of gauze. The incision is closed by a continuous suture of No. 0 catgut (Fig. 7), the wound dressed and a plaster cast applied. If there is any shortening of the skin or if it is quite thin, care must be used not to cause too much tension with the cast because of the danger of necrosis of the skin. After a week or ten days, the cast may be cut across the sole and pressure applied by means of wedges to secure greater correction. This is continued until the deformity is entirely overcome. Walking is then begun, in the cast for one or two weeks and then in a flat-soled shoe, and stretching is employed by the patient for the succeeding three to six months.

Fig. 7. Incision closed.

It may be urged by some that the loss of the plantar fascia may permit a subsequent sagging of the arch of the foot, but

after four years of observation, I have not seen this occur. The scar in the skin will contract if it is not kept stretched, but presents no trouble if walking and stretching are followed out persistently. Tendon transplantation of the dorsal flexors, astragaloscaphoid arthrodesis, or cuneiform osteotomy may be performed in the more severe cases in addition to the fasciectomy. In the minor cases, they will not be necessary.

The principle of the operation, then, is the removal of the structure that is primarily responsible for the deformity and that is the cause of relapse and the continued progress of the deformity, and its replacement by a tissue (fat) which does not contract.

[SURGICAL SUGGESTIONS]

AN "impulse on coughing" without a bulging sac is not a hernia. A large inguinal ring is not a hernia nor a portent of hernia. On the other hand, if a patient is sure that he has seen a hernial protrusion he probably has a hernia even though, as occasionally happens, coughing and straining do not demonstrate it at the time of examination.

IN children, especially, it is often difficult to find an inguinal hernia, even though the parent has seen it. It is usually safe to accept that observation.

BILATERAL inguinal herniae that project on coughing and immediately recede are almost always direct, and frequently contain some of the bladder.

COMPLETE ablation of the sac, by high ligation, is the most important step in an inguinal hernia operation. In children it is usually all that is necessary. It is also important, especially in adults, to close snugly around the cord the stretched transversus fascia—the opening in which constitutes the abdominal ring. In properly selected cases these two steps are sufficient to cure an indirect inguinal hernia without any plastic on the canal.

THE MEDICAL ASPECTS OF
CHRONIC GALL-BLADDER DISEASE

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WITHIN the last decade we have been through three phases in the consideration of disease of the gall-bladder. At first, it was felt that only gallstones or acute gall-bladder infections could cause symptoms, and therefore the dictum that gall-bladder disease was a surgical condition was established. There followed a period when it was recognized that a large proportion of chronic digestive symptoms are caused by gall-bladder disease other than stones, and the treatment of these conditions quite naturally was delegated to the surgeon. But surgery has not been as successful in the cure of patients with chronic non-calculous disease of the gall bladder, even though the operative technique has been constantly improved. We have therefore entered upon a period in which the reason for the failure of relief of symptoms, even though the gall bladder was removed and frequently found really diseased, has been proved to be due to the fact that the gall-bladder inflammation is only a part of a general chronic infection of the whole gastrointestinal tube and its appendages. Coincident infections of the stomach, duodenum, liver, pancreas, appendix and colon have been almost invariably demonstrated by clinical tests and laboratory and roentgenological findings. The diagnosis of gall-bladder disease therefore becomes of rather minor importance, and the demonstration of its complications is the principal aim of the clinician.

DIAGNOSIS

The diagnosis of chronic gall-bladder disease is not such a simple matter as the old diagnostic adage "fair, fat and forty with indigestion" would lead us to believe. While it is true that the greater number of cases are in women past forty, younger persons frequently give definite evidences of having this disease and many men are affected. The symptoms due to the uncomplicated disease of the gall bladder itself are so often masked by those of the other lesions also present that it is difficult to differentiate them. The infected gall bladder, with thickened wall and often distended with concentrated bile, may cause irritation of the duodenum, with which it is in contact, resulting in waves of reverse peristalsis with pylorospasm, which in turn cause fullness or distress after meals, anorexia, heartburn, belching, sour regurgitation and occasionally, vomiting. But most of these symptoms are also those of gastritis, duodenitis and appendicitis, so that only a presumptive diagnosis can be made from them. If gastric or duodenal ulcer is also present, sharper epigastric pains supervene, usually late after meals and relieved by food, although food will continue to produce the fullness or distress caused by the irritation from the efforts of the diseased gall bladder to respond to the stimulation of food in the duodenum. If calculi are present there is often a feeling like a "lump" under the right rib margin or in the back, while the attempted passage of a stone will cause the well-known typical symptoms of biliary colic: severe right upper abdominal pain, reflected to the right scapula and accompanied by vomiting and, if the stone remains impacted for a sufficiently long time in the common duct, icterus.

Various laboratory findings are of aid in establishing a diagnosis of chronic gall-bladder disease, the roentgen ray having for some time been our main reliance.

The direct visualization of stones has been greatly aided by the invention of cholecystography. This consists in the administration, by mouth or intravenously, of 30 to 50 grains of the sodium salt of tetraiodophenolphthalein, which being excreted by the liver exclusively, renders the bile more or less opaque to the roentgen ray due to the presence of the iodine radicle. This method gives us an opportunity to observe the size, shape and mobility of the gall bladder, its ability to be filled by the bile and to expel it, and it renders many non-opaque stones visible by virtue of their being less dense than the surrounding iodized bile. While the observations of the physical characteristics of the gall bladder and of its functional ability are of great interest, it is unwise as yet, especially when using the oral method of administration, to place too much reliance on a diagnosis made exclusively by this method. The older methods of roentgen diagnosis are still available and reliable: the fluoroscopic study of gastric motility showing a prepyloric mass spasm, and of the duodenal cap showing its fixation, the radiographic evidence of a visible, thickened gall bladder, and of a smooth, often cupped-out, and less frequently irregular, deformity of the duodenal cap.

Fractional gastric analysis will show evidences of the attendant gastroduodenal irritation, either a reflex continued type of gastric secretory curve or, in cases of longer duration, an achylia, and the presence of occult blood where the gastroduodenitis is very severe, or visible blood where ulceration has occurred. It may also show the delayed emptying due to pylorospasm.

The examination of the duodenal contents, especially the fractional examination of the bile obtained after the instillation of various substances, especially magnesium sulphate solution, through the duodenal tube, has been held by Lyon and others to be of great diagnostic value. Lyon and his followers claim that by observing the change in color and consistency of the bile as it flows into the duodenum, they can differentiate bile from the common duct ("A bile"), from the gall bladder ("B bile") and from the liver direct ("C bile"). By careful cytological and bacteriological studies of these specimens, especially of the "B" and "C" specimens, they say that a definite diagnosis regarding even the specific infecting organism can be made. Due to the fact that the gall bladder is usually first infected in its deeper layers, with the mucosa often normal even in late stages of gall-bladder disease, it is difficult to see how the Lyon method can be as infallible as claimed, especially when it is realized that there is a constant contamination of the specimens obtained by stomach contents entering the duodenum. My experience with it was very unsatisfactory.

Complications. In the complications of chronic gall-bladder disease various other laboratory tests are of value. Where there is a suspicion of partial occlusion of the common duct, a high icterus index (hyperbilirubinemia) will often show latent jaundice a day or two before skin or sclera becomes stained. The van den Bergh test, showing strong reactions for urobilin by the direct and indirect methods (diazo-reaction to plain serum and to serum treated with alcohol and filtered, that is, with albumin removed) will help to differentiate obstructive from hemolytic jaundice where the symptoms are not typical. Clay stools and bilirubinuria are the indications of severe jaundice.

TREATMENT

The treatment of chronic gall-bladder disease, as of any chronic infective process in the gastrointestinal tract or in any other part of the body, must consist first of all in the search for and thorough eradication of all possible foci of infection. It is now generally conceded that all chronic gastrointestinal infections are as much due to focal infection as are the chronic arthritides, so that local measures, operative, dietetic or medical, aiming to alter the

pathologic conditions in the gastrointestinal tract alone can be today considered only palliative, just as the salicylates are only palliative in arthritis. Removal of focal infections does not mean simply referring a patient to a dentist or a nose and throat specialist and letting the matter rest, but means insistence upon the extraction of all pulpless or badly pyorrheic teeth, as well as of retained root fragments disclosed by roentgen ray, drainage of alveolar abscesses following extraction, and thorough and repeated scalings in pyorrhea. It means the removal of suspicious tonsils and a careful search for postnasal, sinus or ear infections and their thorough cleaning up or repeated treatment. It means radical care for any infections found in the female pelvis, the male or female genitourinary tracts, the rectum or any other localized infections.

The *treatment of the local condition* in the gall bladder cannot be clearly determined unless there is a thorough understanding of the anatomy and physiology of the gall bladder. It must be understood that embryologically the gall bladder is a budding out from the biliary tract, including liver and pancreas, which have grown from the primitive duodenum also by a process of budding. The gall bladder is a reservoir for bile which cannot enter the duodenum because of the closure of the sphincter muscle of Oddi at the papilla of Vater, this closure taking place when there is no food entering the duodenum, that is, after the completion of digestion of a meal. During its stay in the gall bladder, the bile becomes concentrated, due to absorption of water, and some physiologists claim that the gall bladder adds to the bile a secretion of its own, which exerts a regulatory influence on small intestine motility. Ordinarily the arrival of a meal in the duodenum causes relaxation of the sphincter of Oddi, and there is an expulsion of the concentrated bile into the duodenum when it is most needed for digestion. If the arrival of a meal is too much delayed it can readily be seen that there would be a tendency to overdistention of the gall bladder and overconcentration of its contents, which, in the event of a persistent closure of the sphincter of Oddi, would result in ineffectual efforts of the gall bladder to empty itself, and would become perceptible to the individual as a distress or pain in the gall-bladder region. In a diseased gall bladder, with thickened walls, even the arrival of a meal makes it difficult for that organ to empty itself, and overdistention from insufficient eating causes more or less severe symptoms, especially when the efforts at emptying may cause a calculus to be pushed into the entrance to the cystic duct, producing colic. It is a fact that most attacks of biliary colic come on after a period of fasting or infrequent feedings, and may or may not follow the taking of the first good meal after such a period. This fact points the way to prevention of gall-bladder symptoms and improvement in the tone of the gall-bladder wall by frequent feedings, and also explains why, after a long period of insufficient feeding, patients will be quite distressed for the first week after beginning this treatment. In the dietetic care it is not necessary to omit any particular kinds of food except meat, which causes distress in practically all infections of the gastrointestinal tract. The diet should be well mixed and may contain a slight excess of fat, it having been demonstrated that while all food elements stimulate gall-bladder emptying (by relaxation of the sphincter of Oddi), fat does it better than any others. Such a diet would be as follows:

Breakfast: Milk, 1 glass
Cereal, 4 oz., with cream and sugar
Egg, one, soft boiled or poached
Bread and butter
Fruit, raw, any kind

Luncheon: Milk, 1 glass
Egg, 1 soft-boiled or poached
Potatoes, baked or mashed
Vegetables, well cooked, any kind
Salad
Bread and butter
Desert, pudding, Jello or stewed fruit

Supper: Same as luncheon
Between meals, at bedtime, and in night if awake: 1 glass of milk, and crackers, bread or cake.
Olive oil: 1 tablespoonful 3 times daily with meals.

In case of the coexistence of peptic ulcer, this diet would be a little too rough, and frequent feedings of a smooth diet would take care of the dietetic indications in both conditions. In excessively obese individuals, the caloric value of the diet would have to be cut down by increasing the vegetable and decreasing the cereal constituents. In diabetes the necessary diet for this condition could be divided into six feedings.

Medication is usually unnecessary, except in the case of colic, when morphine is of course administered to alleviate the pain. The various cholagogues, such as the saline cathartics, calomel, nitric acid and even the really efficient bile salts, while they may occasion some increase in bile excretion, have been shown clinically and by cholecystographic studies not to exert as much influence on gall-bladder emptying as ordinary food, especially fats and oils. Even in biliary colic, the effect of frequent feedings is to shorten the period of pain and jaundice and to overcome or prevent the disagreeable after effects of the usual starvation treatment.

Lyon's duodenal biliary drainage has had its vogue, but is rapidly losing its prestige. Intermittent drainage, consisting of aspiration of duodenal contents, every day or a few times a week, for a period of a few hours after the instillation of magnesium sulphate solution through the duodenal tube, undoubtedly causes the gall bladder to empty itself, but not as quickly or as completely as fat or oils or any other food will produce the same effect. This has been noted clinically and proved by cholecystography. The effect of such a drainage, therefore, may be compared to that of a meal, and in a gall-bladder patient who has usually been starving as a result of the distress caused by food, the beneficial effect is marked. But the effect of six feedings per day is, as would be expected, much more rapid and marked and produces more lasting results.

Continuous biliary drainage, consisting of thirty-six hour periods of aspiration of duodenal contents combined with duodenal feedings and duodenal lavages, and with intervals of sleep, has more recently been suggested by Lyon as a method designed to overcome the effects of highly theoretical "vicious circles" of reabsorption of poisonous substances expelled by a diseased biliary tract into the duodenum. He removes from three to six gallons of bile during a two to four weeks' treatment. No proof has as yet been presented that these "vicious circles" really exist, that any so-called "toxic substances" are reabsorbed. The removal of such large quantities of bile, especially of the bile salts and pigments, which the biliary tract uses repeatedly in carrying on its digestive function, would seem theoretically to be a procedure that might cause serious damage, and many patients after such treatment appear much depleted. As this treatment can be entirely dispensed with, so far as clinical results in practice are concerned, it is not to be recommended.

Surgical treatment should be confined to cases in which complications not possibly affected by medical treatment require operative procedure for their removal or alleviation. Less than 10 per cent of all cases of chronic gall-bladder disease will fall into this group. Except in surgical emergencies, operation, even if definitely decided upon, should be deferred, if possible, until dietetic treatment has been carried out and all focal infections have been removed. Such a course, if followed in every case, will prevent many of the unpleasant immediate and later postoperative complications, will reduce operative mortality to a minimum, and will often occasion such marked improvement in the patient's condition that the necessity for operation may be obviated. The complications often necessitating operation include

the presence of calculi, adhesions or cicatricial deformities of the gall bladder, producing persistent symptoms. If no symptoms are present that could be attributed to the presence of these complications, operation is not to be considered.

It must be remembered that "silent" gallstones are very prevalent, and if proper non-surgical treatment will put a case of gallstones in the "silent" class, it is best to act as if gallstones had never been discovered. The only argument in favor of removal of "silent stone" gall bladders is that carcinoma may develop, but it has never been shown that the percentage of occurrence of malignant change in calculous cases exceeds or even equals the mortality from operation.

In the cases with symptoms caused by deformities resulting from pericholecystic or periduodenal adhesions or cicatricial contraction, the necessary plastic operations are so difficult and so uncertain in their results that they should be performed only as a last resort. Chronic pancreatitis, probably a very frequent if not invariable accompaniment of biliary tract disease, usually clears up with the latter, but complications such as calculi may require operation.

Postoperative treatment is very important. With the removal of the gall bladder, the physiology of digestion has been modified. There is no concentrating reservoir for the bile which cannot enter the duodenum between meals when the sphincter of Oddi is closed. The accumulating bile must back up into the liver or dilate the common duct or the stump of the cystic duct. The dilated cystic duct may eventually take over at least the motor function of the gall bladder, but will probably never be able to concentrate the bile. During the development of this dilated stump into a functioning bladder, overdistention, with its consequent train of postoperative reflex digestive symptoms, must be avoided by producing frequent Oddi sphincter relaxation and biliary tract emptying. This is best accomplished by means of the frequent feedings before described. At least six months or a year of careful dietetic treatment after operation will prevent many disagreeable aftereffects. Any recurrent or persistent focal infections will cause inflammatory complications and should be constantly watched for and thoroughly eradicated when discovered.

SUMMARY

1. The diagnosis of chronic gall-bladder disease is based on the history, the roentgenographic findings and some laboratory findings.

2. The treatment is essentially medical, and consists of dietetic stimulation of biliary drainage and removal of focal infections.

3. Surgical treatment is to be confined to the complications of the gall-bladder disease.

4. Postoperative treatment is important.

THE INTERNIST'S PROBLEM IN ANESTHESIA*

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DOCTORS and laymen generally link surgeons and anesthetists together and seldom associate an internist with a surgical operation. Until recent years this association was quite natural, as all surgical procedures were "operations of necessity," that is, undertaken only when there was a distinct hazard to life unless some intervention was carried out. However, conditions are rapidly changing and at the present time, when great advances in skill and improvement in mechanical devices have made surgery safer and surer, and the studies of chemists and anesthetists have refined the various means of abolishing consciousness of pain in connection with it, many operations are performed daily when conditions are not such as to threaten existence, the object being to improve health, to add to the enjoyment of life and to prevent a real emergency operation at a later date. In fact, today there are probably more operations performed that are optional than that are compulsory.

In an emergency, a life-and-death condition, there may be no place for the internist, but in all operations of election there are ample time and opportunity to place the patient in the best possible condition to withstand the ordeal. In this there is definite work for the internist and there should be complete cooperation on his part with the surgeon and the anesthetist. The surgeon and the anesthetist must accept conditions as they find them; the internist can, in a large measure, shape conditions to meet the needs of the special occasion. Although he cannot make a hemophiliac or a lymphatic subject into a desirable surgical risk, his superior opportunities enable him to recognize these unfortunates in the beginning and to decide how, if at all, it will be possible for such subjects to undergo an operation.

The physician who refers a patient for a surgical operation requiring an anesthetic must be concerned as vitally in the kind of anesthesia employed and the competency of the anesthetist as in the qualifications of the surgeon who is to perform the operation.

Responsibility for the patient, who in the final analysis is the one most concerned, renders it essential that internists, who fully appreciate the safety of their surgical patients, should familiarize themselves with the patient's general condition and should have practical knowledge of the principal anesthetic agents and the ability and experience of the anesthetist. Especially is he concerned with the effects of anesthesia, for it is here that more risk and uncertainty usually exists than in the operation itself. "Surgical shock" is still an ill-defined entity and just how much of it is due to operative trauma and how much to the effect of anesthesia we are not as yet certain. However, the metabolic disturbances that follow operations have been studied and evaluated, so that we are today in possession of a wealth of information which is of help in placing a patient in a condition that will offset the many disadvantages imposed upon him and enable him to pass through the ordeal triumphantly.

Most of the drugs employed for the production of general anesthesia, if used in high concentration or for a sufficiently prolonged time, produce a toxic effect which is the more serious if the organs are more

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or less damaged and are unable to offer normal resistance to this toxic effect. The internist who is familiar with the history of the patient and who has had him under personal observation is the one qualified to judge whether his condition warrants the use of a general anesthetic, or whether local or regional anesthesia alone is indicated; further, whether the use of a particular anesthetic drug is contraindicated or not and of the precautions that are necessary during the anesthesia. These are matters on which the safety of a patient depends during the ordeal of an operation and after it. Insufficient attention is given to them and I think that it is safe to say that probably not more than one-third of the patients operated upon in the hospitals of the United States receive the protection that a searching preliminary examination by a competent internist accords. While such an examination is admitted in principle as absolutely necessary, it is very often slurred over or omitted in practice; and the fitness of a patient to be submitted to general narcosis, as well as his observation during its course, is frequently left to one who has had little, if any, practical experience in administering anesthetics.

A rigid examination of all patients will show about one-third to be poor surgical risks, and the results of haphazardly operating under such conditions is one of the reasons for the old saying that "the operation was a success but the patient died."

The preparation of a patient to receive an anesthetic for a surgical operation is in reality more important than the postoperative care, for if there has been ideal preoperative attention, there will be little need for postoperative management. In addition to the comfort of the patient in the postoperative days and to his general health during and following convalescence, there is an economic problem to be considered, viz., the number of days in the hospital. It is an investment for the patient, and not an expense, for him to be put into the best possible condition before any surgical procedure and to have the anesthetic administered in as skilful manner as can be done only by the expert anesthetist, for these will reduce his hospital days and nursing hours. Many people, and most surgeons, think it is sufficient that the patient recovers from the operation, and scant attention is given to how long it takes to return to normal or what degree of comfort is experienced during this time. Everything is judged by comparison. Few patients have had a previous operative experience and if they are weeks in recovering normal health they believe it was due to the serious condition they were in. They do not appreciate the fact that many details in their particular cases were overlooked.

GENERAL EFFECTS OF NARCOSIS

In considering the general effects of narcosis, we must remember that as yet there is no ideal anesthetic agent. No method of producing anesthesia is free from danger; this danger may be greater with one patient than with another and may be greater with one operation than with another. This danger may be greater or less with the same patient at different times and with different conditions according to the fluctuation of his own health. Deep narcosis may be considered as always producing more or less damage to the lungs, bronchi, kidneys, liver, etc., although such effects may not always be clinically evident. Naturally, if these organs are already damaged, or if the patient has a generally poor resistance, or if his system is already overloaded with toxins, the effects will be more severe. It is reasonable to assume that there is some pathological process present in the various organs of the body from the fact that there is a condition present which requires operative measures. It is rapidly coming to be recognized by the discriminating members of the profession that complications and death following surgical operations are due less to the mechanical surgical manipulations than to preoperative failure to recognize the unfitness of the patient or to prepare him

properly to undergo the surgical and anesthesia risk.

Patients surely have the right to expect that every aid which the internist can furnish them for the ordeal, and even his presence, if necessary, during the operation should be given. They also have the right to expect that the anesthetic will be given by one fully qualified and experienced in this important department. In fact, the anesthetist has a broader function than is usually ascribed to him and he should, in many cases, be in a consulting capacity even to the point of making a decision that an operation should be recommended and at what time. In doubtful cases it is our custom to have the judgment of the anesthetist before deciding upon operative measures.

NON-SURGICAL CONDITIONS AFFECTED BY ANESTHESIA

It is more important to consult the internist today than in the past, owing to the fact that in the early days surgeons were all physicians who added surgery to their previous experience in general medicine, whereas today most of the surgeons lack this general medical experience. The training the surgeons receive today causes them to become skilful operators and by the very perfection of this surgical technique they are deprived of the opportunity of prolonged observation of any particular patient. Also the early surgeons were, as a rule, well acquainted with their patients and knew their peculiarities, whereas today many surgeons are operating only on case "XYZ." The operation is, in many cases, routine and as we all know that constant repetition makes for perfection, the surgeon who has performed a thousand appendectomies should have perfection of their surgical technique, but this does not tend to broaden the surgeon's view and understanding of the individual case. Our present system of training practically makes it impossible for the surgeon to acquire judgment regarding the non-surgical phases, which can be considered only after prolonged observation. He cannot be expected to be keenly alert to the non-surgical factors which may be equally important in obtaining results for the patient.

In many conditions, it is far more important that the anesthetist look to the internist than to the surgeon, for the internist has studied the patient as few surgeons will do and the diagnostician owes his patient a certain service after a decision has been made to operate. There should be a constant understanding between the internist, anesthetist and surgeon and the patient should be made to feel that all are "on the job." The internist has to consider many problems presented by the patient and he must constantly be alert to those that will confront his colleagues.

Let us consider some of the conditions most frequently affected by general anesthetics. Ether is likely to aggravate existing pulmonary defects, but the acuteness of the lung condition is far more important than the extent of the involvement. Chloroform aggravates kidney and liver defects and produces pathological conditions in them.

The history of a patient in regard to these organs and their functional value should be accurately known before he is submitted to the effects of these narcotics. Diabetics and alcoholics are quite apt to develop acapnia and cyanosis during anesthesia. These and similar conditions are not given sufficient attention when a patient is rushed to an operation.

Acidosis. The usual anesthetic drugs tend to produce acidosis. As Carey[1] remarks, anesthesia usually means anoxemia, insufficient oxidation, increased acidity and acidosis. Impaired kidney functioning, chronic infections, in fact all diseases that drain the body of alkali reserve are factors which in prolonged anesthesia induce symptoms of acidosis, which is found to occur in from 15 to 20 per cent of surgical operations. The postoperative condition of the patient corresponds in general with the condition of the patient before anesthesia.

Liver Conditions. The particular effects of ether and chloroform on the liver must be kept in mind. Although it is generally known that permanent damage to the liver and cholemia are produced by chloroform (especially in the presence of abdominal disease, as shown by Reichel[2] and Vorschütz[3]) yet it is not generally known that ether may produce similar effects. In 1910 Rathery and Saison[4] showed experimentally that hepatic and renal lesions produced by the use of ether were as frequent and probably as severe as those caused by chloroform and that the histological lesions were similar. It is not necessary here to enter into a discussion of how cholemia is produced, but only to remark that it seems most probably to be due to the anesthetic and is not, as stated by some, a postoperative effect. The point is stressed that a healthy liver and healthy kidneys are necessary to eliminate the increased acids produced in the body during narcosis and that if the patient is showing signs of hyperacidity before operation the postoperative acidosis is more certain to occur. For a number of years it has been known that the administration of an anesthetic, even to a perfectly normal individual, is followed by "small but very definite changes in metabolism."[5] It has likewise been established by Crile[6] "that nitrous oxide, ether and chloroform during their administration all produce increased acidity of the blood" and also "that the acidity of the urine is increased markedly under ether and chloroform—less under nitrous oxide."

Cardiorenal Condition. The cardiorenal case requires special attention before being submitted to the risk of narcosis. The more uncertain hearts from an anesthesia standpoint are those having a profound myocardial change such as occurs in long-continued toxic infections. The main question to answer is as to the tone of the heart muscle. This is much more indicative than heart murmurs or slight irregularities, as it is most important to know what reaction the heart muscle of an individual patient will be when subjected to extra strain.

Owing to the fact that the severe postoperative complications in cases showing cardiac or renal defects can mar the most brilliant surgery, it is a matter of extreme importance for the patient that, when time allows, he should be subjected to prolonged observation and all necessary examinations and laboratory aids before operation, and, furthermore, that the medical means of improving the patient and correcting defects should be applied.

Obesity. The patient who suffers from obesity must always be considered a poor subject for anesthesia. The mere fact that he is obese tells us that there is faulty metabolism and we know a condition of anoxemia exists. Giving such patients only a restricted diet to follow will not correct the condition as it does not reach the cause; in fact, all short-cuts for reducing, such as the various diet fads and the use of reducing drugs, can only be condemned, for they are harmful to the patient. The fair, fat and flabby patient is in this condition as a result of lack of exercise, improper breathing and overindulgence in food evidenced in glandular dysfunction. It is far better to permit the patient to eat with appropriate dietary control than to change to a starvation diet. It is important that the patient receives proper direction in regard to exercise and breathing in addition to restricting the food intake. The obese patient is daily carrying excess baggage and has not the desire to exercise. Not only are the skeletal muscles of the body abnormal in the obese subject, but the heart muscle is likewise involved. Such a patient has not only a fat body, but in time, owing to the faulty circulation, he has what may be known as a "fat head". It is difficult to secure cooperation from such a person. The weight of the patient should not be considered so much as his physical condition; and following the various fads to reduce weight will not place the patient in a better condition for an anesthetic. Proper nourishing food, regulated exercise and sufficient oxidation are more essential to the fat person than to the lean; and, to repeat, starvation methods and the use of drugs for reducing can only be condemned.

Age. The age of the subject has an important bearing upon the condition induced by anesthesia, for when old animals were used in laboratory experiments it was found that ether was much more toxic for them than for the younger subject, for "the old organism has an acid-base balance of the blood which is not stable, and can be readily reduced by the use of such an anesthetic substance. When such a reduction has been effected in the reserve alkali of the blood of such animals there develops a reduction in urine formation or the establishment of an anuria. The urine contains albumin and casts and, more rarely, diacetic acid. The elimination of phenolsulphonephthalein is greatly reduced or present in the urine as an indeterminate trace." The "toxicity is first expressed by the anesthetic substance inducing such a change in the physico-chemical state of the blood that one organ at least, the kidney, is furnished blood of such altered composition that it fails to functionate in a normal fashion. It would appear that, prior to the use of an anesthetic in an aged person, the organs should be protected against the anesthetic by the use of a diet rich in carbohydrates, and by the judicious use of medical measures, in order to maintain during the anesthesia a normal acid-base equilibrium of the blood."[7]

EXAMINATIONS

The casual routine and standardized examinations and tests applied by inexperienced hospital interns are in no way sufficient. It is very little credit to medical science generally that the patient should undergo the trying, expensive and dangerous ordeal of surgery only to exchange one miserable state of existence for another that may even be worse. In the preoperative study of the patient, it is not only necessary to know the functional ability of the heart, the kidneys and the liver, but attention must be given to every detail that will give information as to the individual's general condition. In making these observations the internist should be considered remiss if he fail to employ every possible method of precision, for the guess-work that has all too often marked such examination in the past can now largely be eliminated. Much attention is now being given to the blood pressure, which should be ascertained under varying conditions, and to the state of the blood vessels. This is essential, but there is danger that in placing too much importance on this particular aspect of the case, others of no less importance may be overlooked. Anyone with sclerosed arteries is a poor subject for anesthesia, but this danger is more generally recognized than others. It is not always the patient with a hypertension who is a dangerous anesthesia risk. The patient with too low blood pressure is many times a greater risk. The important question is the pulse pressure and how the patient's pressure will react under an anesthetic.

Breath-holding Test. More than a dozen years ago Yandell Henderson[8] of Yale suggested a simple breath-holding test that is one of the simplest tests to use yet is seldom employed. This test is an excellent index of the functional ability of the heart and kidneys. One of the most striking facts deduced from the study of the breath-holding test is that one-third of the postoperative deaths occurred in those patients whose powers of respiratory suspension were subnormal and it was observed that the hazards of anesthetization were greater as the power to hold the breath became poorer.

Gilbert Fitz-Patrick[9] in 1922 reported a series of 871 obstetrical cases in which he employed the respiratory suspension tests and carefully demonstrated the importance of this simple procedure. I now employ the test as much as a routine measure as taking the blood pressure and I consider it one of the most valuable indications of the patient's condition. I will not advise an operation if the patient cannot hold his breath at least fifteen seconds. In such a case, it is necessary to hunt for the cause and to correct it.

Urinalysis. A patient may show acidosis without acetone in the urine, or aceto-

nuria may exist without acidosis. If he is already suffering from malnutrition or pathological conditions existing in the lower alimentary tract, such as will induce catabolism of fat and carbohydrates, acidosis is likely to be present. Mere traces of acetone need not arouse anxiety, but if it is present in noticeable quantities, it is certain that the administration of any anesthetic will lessen hematogenous alkalinity and produce overwhelming intoxication.

Continued routine urinalysis is essential.[10] The perfunctory examination of a single specimen or of urine collected in hospital vessels is of negligible value. A report of the presence of acetone or diacetic acid must always be investigated, since many drugs, such as acetanilid, aspirin and migraine remedies taken by laymen as the result of promiscuous advertising, will cause reactions simulating those in delicate color tests. It is absolutely essential to *exclude the taking of drugs* if the examination of the urine is to give information of value.

The careful study of a properly collected twenty-four hour specimen of urine is most important for all prospective operative patients. Clifford Mitchell[11] has described in detail the collection and examinations of the twenty-four hour urine specimen. When the collection is concentrated, which can be obtained only by limiting the intake of fluids, and is preserved so as to prevent decomposition (refrigeration is the only ideal way to preserve it) we know from experience that reliable information is obtained that may warn us before other manifestations that the patient is in an abnormal state and that conditions must be corrected.

THE PERSONAL EQUATION

There remains to be considered that intangible but nevertheless highly important factor in the success or failure of any surgical procedure, viz., the personal equation, which is so often overlooked, especially in institutional work. The "professional manner" of the anesthetist has been dealt with often and at great length and systems have been worked out to take care of the psychic element which, if not sufficiently considered, may nullify all our labors. It remains, however, for the internist who is intrusted with the preoperative preparation to see that the patient is in that frame of mind where he will approach the anesthetist with the serenity and calmness so essential to satisfactory results and will take the anesthetic without fear or excitement. For the accomplishment of this the internist's personal equation is quite as important as the patient's and there is no part of his by no means easy task that offers more opportunity for individual expression and true professional skill.

CASE REPORT

One case will illustrate how a poor surgical risk patient can be placed in such a condition that he can be classed as a good risk:

In May, 1923, a woman fifty years of age was referred for a diagnostic study. She had been under the care of many different physicians and, although an invalid for years, little attention had been given her except drugging by doctors and manipulations by drugless healers. The diagnostic study revealed a chronic cholecystitis and cholelithiasis, but it was far more important to consider the general condition of the patient than the fact that gall-bladder disease and stones were present. She was generally exhausted and although no true jaundice was present, she looked like "putty." Respiratory suspension was only ten seconds. The heart tones were without force. The pulse pressure was less than 20 mm. Hg. The urine examination showed a marked kidney disturbance and the blood chemistry findings showed a carbohydrate intolerance. The acidity was 70° and the pH. was 5.2. This patient gave a history of "blinding headaches" for years and was unknowingly an aspirin addict. She had also had many acute attacks of neuritis and acute gall-bladder colic for which doctors had repeatedly given opiates to relieve the pain, but the drugs added to the general toxic state. Also she had been a constant user of cathartics.

She was placed in training for an operation and from the beginning I realized that I did not have just a condition to meet but a problem to solve. The result was not obtained by drugs,

but by management. It was not obtained in a day or a week, but when the patient appeared in the operating room, she was not a poor risk patient and her hospital days were even less than the average. Of course, appropriate dietary methods were employed. The patient's elimination was improved by scientific massage and systematic, graduated exercise was instituted. By massage, rubbing is not referred to and by exercise I do not mean motion. Exercise must include mental activity as well as physical. Housewives may do a large amount of labor in a day, but it is in many instances only routine drudgery and is in no sense exercise. This patient was taught how to breathe and it was seen that she did increase her oxygen intake. In the beginning the passive resistant exercises were employed and, later, walking with deep breathing and instructing her to hold her breath and to count the number of steps she could take while holding her breath. With the improvement from following the dietary rules, the increased oxidation, the increased cell elimination and the return to normal of the acid-alkaline balance, the necessity for the use of drugs disappeared. When it was decided to operate, the patient's pulse pressure was 40 mm. Hg.; the respiratory suspension was 45 seconds; the twenty-four hour collection of urine showed a normal acidity with all indicators; indican was slight and there was no sugar or albumin present; likewise the small granular casts and red cells had disappeared. The blood chemistry findings were also close to normal standards. This patient's operation in August, 1923, confirmed the diagnosis. She made an uneventful recovery and had a minimum of postoperative discomfort, leaving the hospital on the fifteenth day. This was more than three years ago; and she continues to enjoy better health than for many years and she is an active and useful member of society.

SUMMARY

The gist of what I have endeavored to say is that, owing to the many complications that may result from anesthesia, it is imperative that every patient who is to be submitted to it should have a thorough preoperative examination and preparation by the internist referring the patient or else by a responsible internist in the hospital. It should not suffice that the patient be left to the casual tests of the anesthetist a few minutes before the operation commences. There should be complete cooperation between the internist and the anesthetist as to the advisability of subjecting the patient to anesthesia just as there should be complete cooperation between the internist and the surgeon as to the necessity of the operation, the preoperative care and the postoperative management.

The internist must not only possess himself of the patient's confidence; he must extend that confidence to include the other practitioners who are to minister to the patient. It is his tact, his patience and his interest in the results to be secured by the patient that are vital. To accomplish all this is not easy, and to many it may be impossible. Yet this is the heart of the internist's problem, and to its solution he must bring all his best resources if success is to crown not only his own efforts but those of his colleagues, the surgeon and the anesthetist.

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THE PRESENT VALUE OF DIATHERMY IN UROGENITAL DISEASES*

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I HAVE chosen this subject for two reasons. In the first place, I believe that we are all interested, in some measure at least, in the various uses of diathermy in urological work. In the second place, the great enthusiasm that this relatively new form of therapy has aroused in recent years, its rapid development and the frequency with which new uses are being found for it make it expedient, in my opinion, to pause occasionally to review the subject and make certain that all our efforts are fully justified on the bases of fact and general experience. It is my desire merely to discuss the present status of diathermy as it applies to a particular field.

The use of physical forces in the treatment of disease has created an important branch of medical practice that has grown strikingly in the past decade, and that bids fair to assume still greater proportions as time goes on. Certainly when we consider the number of our specifics in the long list of galenicals and chemical medicaments, it is not difficult to believe that physical agents may offer in increasing numbers new and effective means of combating non-surgical affections. By physical agents I refer, of course, chiefly to radium, roentgen ray, ultraviolet light, and electric energy as now employed in diathermy. Surely for the urologist the importance of these forces has grown very rapidly. We could ill afford to spare radium and the roentgen rays; and we have been fast in finding new value in diathermy both as a method of therapy in itself and as an adjunct to surgery in the treatment of malignant disease.

DEVELOPMENT OF USE OF HIGH FREQUENCY CURRENT

The use of high frequency current "for the production of thermal effects in the depths of tissues," as Zimmern has well defined it, has developed surprisingly since D'Arsonval, Elihu Thompson and Tesla (1889–1891) first demonstrated that such current could be safely passed through the human body with the resulting production of heat, and without the trauma and muscle-nerve stimulation attendant upon the use of ordinary galvanic or faradic current. Indeed, the uses and the suggested uses of diathermy have been so multiplied in the past few years that there is danger, unless we are cautious, of permitting enthusiasm to run ahead of fact. Progress, to be sure, comes with acceptance of the new, but the mere newness of the method alone does not warrant its acceptance. It is true, of course, that diathermy deserves a definite place in our list of therapeutic measures, and I believe that its importance is destined to become greater; but I do not believe that we should sponsor every claim concerning it, or attempt to define its usefulness with any degree of finality until we have more of actual knowledge concerning its benefits and its limitations. In certain conditions its efficacy has been well demonstrated; in others we must still reserve judgment. It is a potent weapon capable of harm as well as good, and if we are to use it safely and to the point of its maximum effectiveness, there is much that must still be learned about it. I fear that in the case of diathermy we have too often

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and to too great an extent been using the medicine without clearly knowing the amount prescribed, its path through the body, the safe limits of dosage, or even its exact identity in the tissues. I wish by no means to imply that the medicine is not good, but rather to urge that we must answer certain fundamental questions before we can fairly expect to use it to its greatest advantage.

DOSAGE CONTROL

When we are using heat, for example, through diathermy, just how much heat is being generated in the tissues under treatment? In other words, what is the dose? Inaccuracy of dosage until recently has been the greatest lack in this form of therapy and the greatest obstacle to its sound progress. Dosage has been spoken of generally in terms of amperage, which really denotes nothing but the amount of current delivered by the particular apparatus in question. Amperage in no way denotes temperature. The degree of heat developed in the tissues depends rather upon a variety of additional factors, such as the varying resistance offered by the tissues between the electrodes, the loss of heat by convection through the efficient cooling mechanism of the blood, the size and position of the electrodes, and the length of the exposure. This offers a complicated problem, but it is heat nevertheless that we are using, and heat, therefore, that we must learn to measure if we are to treat the lesion accurately, and at the same time protect with certainty normal structures. The results produced in the given case will always be the product of just two factors: the degree of heat developed at the site of the disease, and the length of the exposure.

Definite progress, I am glad to say, is now being made with reference to this most fundamental problem in diathermy, the measurement of dosage. There have been devised various types of active electrodes that hold thermometers, thus giving an approximate idea, at least, of the temperature developed during the course of the treatment. While this is a very distinct advance as compared with previous methods in which sole dependence was placed upon the finger of the operator or the sensations of the patient, it is not ideal, for at best such electrodes can inform us only concerning the degree of heat within the instrument itself. When it is remembered further that in diathermy the rise of temperature is produced within the body tissues and that such an instrument must receive its heat from those tissues, the lag in temperature-recording and the error involved become obvious. It is knowledge of the degree of heat within the body, at the site of the lesion, that we must hope to obtain.

A solution of this problem has been offered, I believe, by Professor Bovie of Harvard, in the form of minute thermal junctions embedded in the points of hypodermic needles, or embodied in the tips of the active electrodes. These thermal junctions may be applied at will, to the surface or depths of the tissue to be treated, and will record constantly, and with greater accuracy than a thermometer can be capable of, the temperature developed in the area in question during the whole procedure. The record is read, of course, upon a microgalvanometer, which has been especially calibrated for the purpose, in terms of units of heat instead of units of electricity.

This method, which we have called "controlled diathermy," has already been described in a recent publication by Bovie, Cunningham and myself,[1] in which we especially suggested its usefulness, combined with surgery, in the treatment of malignant tumors of the urinary bladder. Here, as is well known, there is urgent need, in the use of diathermy, to know with certainty that sufficient heat has been engendered to destroy the growth

[1] Bovie, W. T., Cunningham, J. H., and Graves, R. C. Controlled diathermy; new method for treatment of bladder tumors. *J. Urology*, 1925, xiv, 411–418.

and at the same time to know with equal certainty that normal tissues and vital structures are not being damaged beyond the point of recovery. We suggested for this particular purpose, therefore, a series of multiple thermal junctions placed in the tips of needles, which may be implanted around the periphery of the growth as outposts protecting against the too great spread of heat. We use, in addition, vaginal and rectal bougies containing thermal couples anteriorly placed, for the safeguarding of these organs against trauma in the destruction of those tumors that involve the bladder floor.

This principle of controlled diathermy is applicable, of course, to every field in which diathermy is used, medically or surgically, and I believe that Bovie's method in some form will be embodied in the diathermy apparatus of the future. Certainly it offers accuracy, and just as certainly it is accuracy that we must have.

OTHER PROBLEMS IN DIATHERMY STANDARDIZATION

The whole problem of standardizing diathermy is a highly complicated one, and its complexity grows as we become better acquainted with it. There is surprisingly little dependable scientific information on the subject, with reference to the most basic considerations, and there is opportunity here for research of the greatest interest and of the greatest practical value. What do we really know, for example, of the path of the heat or the current through the structures between the electrodes? Have we been taking into consideration the great differences in electroconductivity of the various tissues that make up the body? Resistance offered to the current is by no means uniform. Bone and skin, for instance, present a high resistance, while muscle conducts the current very readily. Again, what do we really know about the degree of heat to which normal living tissue can be subjected for a given length of time and still recover? The evidence available on this point is surprisingly meager, and yet what question can be more vital in the safe employment of electrothermy. What are the differences in sensitivity to heat between the normal cell and that which is diseased? These and many other questions present themselves in any careful consideration of this subject. I submit them, not as hopeless difficulties, not as reasons for despair, but rather believing that the game is worth the candle and therefore should be well played.

I am reminded in this discussion of the favorite challenge of the late Dr. Lovett to his students. It seems to me to be pertinent in many of the fields of our endeavor. "What are you trying to do? Is it worth doing? Are you doing it?"

UROLOGICAL INDICATIONS FOR DIATHERMY

The space allotted to me here does not permit a detailed discussion of the conditions in which diathermy may be properly employed in urological work. In general, however, we may classify them as medical and surgical.

Medically, this form of therapy is chiefly applicable to the treatment of the most common urogenital infection, gonorrhea, and its complications. It is based upon the established fact that the lethal dose of heat for the gonococcus is relatively low as compared with that of other common pathogenic organisms, and upon the further assumption, which is probably correct, that the gonococcus may be destroyed by a temperature that will not at the same time damage the tissues of the host. Common clinical experience has frequently demonstrated the sensitivity to heat of this particular microorganism. It has been repeatedly observed, for example, that a profuse urethral discharge has subsided with the advent of some intercurrent general infection, characterized by marked pyrexia. It is true, furthermore, that the gonococcus flourishes nowhere better than in the anterior male urethra, in which the temperature, normally, has been demonstrated to be well below 98.6° F. There is also abundant laboratory evidence to sub-

stantiate the fact that this organism may be readily destroyed by relatively low temperatures. Unfortunately, however, these experimental observations have been based largely upon studies of cultures grown upon the surface of artificial media. In an effort to approximate a little more closely the conditions existing in the body, I have had cultures embedded in the depths of moist media, subjecting them to various degrees of heat, to determine their lethal dose under these conditions. Fifty-three degrees Centigrade for ten minutes were found to destroy all growth. These are imperfect analogies, however, and there is an interesting opportunity for useful research which will define exactly the temperature necessary to kill the gonococcus in a given period of time, when it is actively growing in living human tissues.

Of course there are other general considerations in the use of heat in the treatment of infection. By increasing the activity of the circulation in the part involved, heat also serves to bring to the disease area an increase of those blood-borne bactericidal elements which the individual normally possesses, and which largely constitute his natural defense against infectious processes. Thus heat serves a double purpose in producing conditions more favorable for the host and less favorable for the invading organisms.

In theory, therefore, we are justified in the attempts that are being made in the treatment of gonorrheal infections by diathermy. The clinical results, however, are as yet by no means uniformly satisfactory. In acute and chronic gonorrhea in the male (urethritis, prostatitis, seminal vesiculitis, etc.), though improved methods may accomplish more as the field is developed, there is as yet no evidence which warrants abandoning the old established therapeutic measures in favor of diathermy. To be sure this form of heat may give symptomatic relief more promptly and effectively in those acute fulminating infections of the prostate that we have usually treated by means of rectal irrigations with hot fluid. Surprising results have been obtained by many, moreover, through the employment of electrothermy in the early acute stages of gonorrheal infection of the epididymis. Diathermy will not suffice, however, and should not be expected to, when actual suppuration has occurred in these structures, at which time surgical intervention offers the only hope of prompt relief.

With particular reference to the employment of high heat in the treatment of acute epididymitis, the recent work of Prof. Carl Moore of the University of Chicago offers new considerations of the greatest interest. This work[1] is so stimulating and seems so pertinent to our present discussion, that I wish to quote briefly from some of the author's conclusions. He builds his case as follows:

"From our results so far obtained there emerges conspicuously the larger general conception that the scrotum of mammals is a structure the function of which is to regulate the environmental temperature of the testes; it is a local thermo-regulator of the male mammal and controls the activity of the testis by providing an optimum environmont for spermatogenesis. That it is essential for the continuance of germ-cell differentiation is beautifully shown by removal of the testes from the scrotum or by experimentally interfering with its function. It is believed that sufficient evidence is at hand to make it reasonably certain that we can now assign to the scrotum a very definite and essential function.

"Mammalian testes transferred as grafts from one animal to another and placed subcutaneously, intramuscularly, or intraperitoneally, may be recovered months later in a condition in which the seminiferous-tubule outlines are indistinct and containing, or not, certain of the earlier stages of spermatogenesis. It has been a problem since first mammalian testes were transplanted to explain the invariable

[1] Moore, C. R. Properties of gonads as controllers of somatic and psychical characteristics; heat application and testicular degeneration; function of scrotum. *Am. J. Anat.*, 1924, xxxiv, 337.

absence of differentiated spermatozoa from the grafts. In certain grafts the tubules will build an epithelium consisting of spermatogonia and spermatocytes, possibly spermatids, but instead of undergoing transformation into flagellated spermatozoa the innermost cells become loosened from the epithelium, are thrown out into the lumen of the tubules, and undergo degeneration. Hundreds of mammalian testis grafts have been studied in this and other laboratories without finding spermatozoa. Not until the testes were transplanted in the scrotum were grafts shown to be capable of differentiating spermatozoa. It appears, therefore, that spermatozoa are differentiated only when the testis is located in the scrotum.

"It has long been known that undescended mammalian testes are without spermatozoa and, for the most part, are devoid of all germinal cells. As long as the testis is retained within the peritoneal cavity it remains degenerate, but if the testis is returned to the scrotum after the generative portion has disappeared regeneration will follow and the testis will return to a normal condition after a few months. The scrotal-testis relationship appears essential for the completion of spermatogenesis. . . . The evidence follows that this relationship is one in which the scrotum functions to regulate the environmental temperature for the testis, and that degenerate conditions are due to an abnormal temperature relationship.

"It has been determined that the testis can be caused to degenerate while in the scrotum by merely insulating the scrotum against loss of heat. The scrotum of a ram was snugly wrapped with woolen materials, taking due precautions against binding or abnormal pressure, and within eighty days the testes were found to be devoid of spermatozoa. The animal sterilized itself with its own body heat because of the interference with the local regulatory capacities of the scrotum.

"An investigation of the temperature of the abdominal cavity, in comparison with that of the scrotum has been made on rats, guinea-pigs, and rabbits with the result that a demonstrable difference has been found to be the normal condition. In every case observed the temperature was from 1° C. to 1.5° C. lower in the scrotum than in the peritoneal cavity at the same moment. This unexpected difference in temperature varies with the external environmental temperature; thus in a white rat, observed in a room temperature of 16° C., it was found that the scrotal temperature was 8° C. lower than that of the peritoneal cavity. An animal sterilizes itself, therefore, with its own body heat if the testes are experimentally or naturally retained within the abdomen.

"Finally, slightly higher than normal temperatures have been applied to the surface of the scrotum to ascertain if it is actually heat that is responsible for degeneration. It was found that degeneration of the generative portion of the testis followed, in part or entire; it may be visible within a period of four to six days after subjecting the scrotum to a single application of heat that is but 7° C. above the normal body temperature. The application of heat is followed by similar reactions, whether given by means of electric light, electric stove, or hot water.

"By submerging the testes direct in a controlled saline bath of 47° C. (117° F.) for five minutes the testis will be found so degenerate that none of the tubules approach the normal condition five days after single exposure."

If we are to accept this work of Moore, and it is interesting that similar experiments and conclusions have been presented separately by Fukui in the *Japan Medical World*, it is at least strongly suggested that diathermy, as now applied to acute scrotal infections, may not be the entirely innocuous procedure that we have believed it to be.

In gonorrhea of the urethra and lower genital tract in the female, a good deal has been accomplished with diathermy, and the technique that is being evolved bids fair to be most useful in combating this

stubborn condition. The easily accessible short urethra can be readily subjected to heat by an electrode placed within its lumen, the indifferent or directing electrode being so applied as to encircle the pelvis of the patient. Similarly the cervix, which is largely responsible for the chronicity of this disease in most instances, may be treated through the use of special active electrodes designed to lie within the endocervix. For this purpose I have devised an electrode which is made in the form of an ordinary wood screw with an insulated shaft. It is literally threaded into the cervical canal, giving more intimate contact with the tissues than can be obtained with the usual smooth-surfaced instrument. It offers a greater area for radiation, moreover, and when withdrawn in its long axis at the close of the treatment serves as a curette to draw away the accumulated secretions and destroyed mucosa.

By these means, the urethra and cervix may be treated in chronic gonorrheal infections with most satisfactory results and, in many instances, with more prompt relief than can be obtained with older methods of medical treatment. The technique requires the greatest care, however, for it is quite possible through errors in judgment or excessive dosage of heat, to inflict damage of the most serious sort. I do not believe that the method should be applied in the very acute purulent stage of the disease, and I do not believe that it should be used in the presence of any demonstrable surgical pathology in the uterus, tubes and ovaries. Employment of diathermy as a glorified hot water bottle in the treatment of salpingitis should most certainly be condemned, as should all attempt to treat the viscera by this means alone, in the light of our present knowledge.

Work of the greatest interest in the treatment of gonorrheal infections in the female by diathermy has been done by Cumberbatch of St. Bartholomew's Hospital in London. His recent book on the subject is an excellent treatise in this particular regard, and in its consideration of the subject of diathermy as a whole.[1] In his treatment of the urethra and cervix, Cumberbatch depends for control of dosage upon the sensations of the patient and the record of a thermometer which is enclosed within his active electrode. His results are most interesting. Dr. Bovie and I, through the Conservation Bureau of the Boston Health Department, are planning the study of this problem at the present time, particularly as applied to vulvovaginitis in infants and young girls, a disease which we have already demonstrated to be of gonorrheal origin in practically every instance. In general we are planning to use the methods described by Cumberbatch, adding, however, the more accurate basis of dosage offered by controlled diathermy.

A word may be said also concerning the value of diathermy in the treatment of the involved joints in cases of gonorrheal arthritis. Heat penetrating through the tissues in and about the joints should be and is of the greatest aid in relieving the symptoms and hastening the processes of repair. Surely, however, in so definite a focal infection, it is not rational to treat the joints by this method alone until the focus of gonorrheal infection has been definitely cured or extirpated by medical or surgical means.

Surgical Applications. In conclusion I wish to mention briefly of the purely surgical applications of diathermy, and to pay my tribute to the remarkable advances that already have been made along this line. Here, diathermy needs little criticism and no defense. The destruction of tumor tissue by desiccating current or its removal by cutting current are now established measures of the greatest usefulness. I am confident, moreover, that the value of electrosurgery is destined to grow steadily greater as methods and mechanisms become more simple, better standardized, and more generally available.

While we still rest solidly on the under-

[1] Cumberbatch, E. P., and Robinson, C. A. Treatment of Gonococcal Infection by Diathermy. Lond., 1925.

lying principles of surgery in the treatment of malignant disease, and while we find invaluable aids in radium and deep roentgen therapy, there are many instances in which destruction and removal of the tumor tissue by heat offer advantages of the utmost importance. We have learned, moreover, that there is no form of heat which compares in effectiveness for this purpose with that of the high-frequency current. This is true because of certain basic considerations which are now well understood. As compared with the actual cautery, for example, it penetrates more deeply and with greater uniformity, and with an absence of char about the electrode, which insulates the tissues against the further spread of heat. Even more fundamental is the fact that the heat of diathermy is formed in the tissues and not in the instrument itself. The relatively recent addition of the cutting current or radio-knife is a brilliant contribution, which aids materially in difficult dissections, in the control of hemorrhage and in minimizing the dissemination of active tumor cells.

Indeed, there is so much of present good and so much of promise in this latest adjunct to the surgery of malignant disease that we should eagerly continue our efforts to develop it to the level of its greatest usefulness. To this end, we must especially accomplish the accurate dosage of heat, whether by controlled diathermy or some other method equally informing, and we must determine with exactness the reactions of living tissues to high temperatures.

It is my earnest plea (and I have but outlined the problem in part) that we do not rest in this matter until we understand as fully as may be the principles underlying diathermy, and answer decisively all those basic questions upon which its successful use depends.

[SURGICAL SUGGESTIONS]

SUTURE of the mesial cut edge of the divided external oblique aponeurosis to Poupart's ligament, while it will unite more surely than will the muscle edge of the internal oblique, introduces no new feature into the arrangement of the canal, except insofar as it narrows the superficial ring and somewhat increases the tension of the aponeurosis. The external oblique aponeurosis was attached to Poupart's ligament before the surgeon split it to open the canal! If, however, the mesial edge of the cut aponeurosis is sutured to the inguinal ligament *beneath* the cord, i.e., if the cord is transplanted to lie upon the external oblique, then, of course, the architecture of the canal is decidedly altered.

PHYSICAL THERAPY

IN ITS GENERAL PRINCIPLES*

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NEW YORK

PHYSICAL therapy has outlived and lived down the false theory that its results are psychic. This is in direct opposition to a statement made to me by a general practitioner that in dealing with sexual impotence, electrotherapy, in his hands, has imaginary results. Small wonder, because if the diagnosis is incomplete the treatment will be inadequate. Furthermore, we cannot deny possible and future results measured in terms of actual and present results, because all our sciences are progressing amazingly into fields unknown. It is high time for a real search for truth, accepting new methods, not without due consideration and test, but with realization that every mode of treatment may possess great merit, and if it does the really scientific physician will employ it.

Correct and full diagnosis is absolutely necessary, and equally important is the quality of the treatment which I have elsewhere described in these words:[1]

"Long treatments of twenty, thirty and forty minutes are the ones which produce the results. During the period of lowest resistance, it is probable that daily treatments are most advisable. For example, one of my friends in the insurance compensation field has found that a daily radiant light treatment in indolent cases will maintain the rate of healing very much better than every other day, although each session may be a half hour long. The physiological results are more important than meter indications, and in diathermy they are more important than thermometer indications because a thermometer cannot possibly reach wherever the current passes. Subjective sensations are important. Those which the patient feels very definitely and may complain about, especially if followed by a reaction after treatment, usually indicate a current so strong that it is apt to defeat its own object. Conversely, a current which the patient does not feel except to describe it as soothing is the very one which is going to do the good."

Periods of rest, imitating the heart action, are paramount. Fatigue is never advisable in medicine, whether produced by physical exercise, exhibition of medicines, or application of electrical and other physical measures. Our organs are essentially delicate, particularly in their cellular structure.

To project a strong electric current at the prostate or the uterus is as foolish as to knock the patient down with a stream of water or to rupture the cervix or the urethra by divulsion wrongly called dilatation. Hence such modalities as the static wave current should be interrupted with the metronome[2] and oscillating currents, such as the galvanic sinusoidal, should be preferred. Variations in these currents should be timed to agree with the pulse rate or a multiple or a subdivision thereof. Patients should always be allowed to rest for a few moments after treatment.

Pain excited or augmented by the treatment always indicates decrease in the energy or change in the character of the current. After-effects of this type must not occur.

Adjuvants must not be neglected, such as attention to the general strength and health, and variation in methods. Hydrotherapy and massage should always be used as associate methods, and practically all electrical modalities should be varied

* Read before the City Hospital Alumni Association, New York City, October 20, 1926.

and coordinated. Only the fanatic relies on one method and one idea.

The use of heat in medicine is about as old as the science and art of medicine itself, but recent knowledge has shown three kinds whose differences must be fixed in the mind of the physician:

1. Conductive heat is that produced by contact, as with a hot water bag or bath. Unless the heat is maintained at a constant level by the regular or frequent addition of hot water, it is of little real value.

2. Convective heat is that produced by radiation from a lamp or other source. This is extremely useful provided the lamp is efficient, the distance from the skin proper, and the length of application correct. After the treatment the skin should remain reddish or blotched for at least fifteen minutes, during which time the patient must rest and be guarded against exposure.

3. Conversive heat is energy (usually electrical) transformed into heat within the tissues themselves by overcoming the resistance of the tissues in passing through and through the site of application.

Hyperemia is analgesic, bactericidal, absorptive, solvent, nutritive, and a stimulant of the blood. It should be made to decongest the wide area surrounding inflammation. The benefit of physicial therapy is that it institutes constructive nutritive arterial hyperemia in contradistinction to the venastatic hyperemia of Bier. Diathermy is the term applied to conversive heat originating from a high frequency current passed through the tissues. Too much attention has been applied to the thermometric element of this heat rather than to its biochemical action upon the entire region, as that of the prostate, including the nerve, arterial, lymphatic and glandular elements. Again the physiological result is of supreme importance and superior to a thermometer reading.

Any current heaps up on the smaller of the two electrodes and determines the point of maximum heat and hyperemia near to itself in accordance with the difference in size between the two electrodes. If the small electrode is a needle, far-reaching caustic effects are delivered by the current jumping or passing from it. It is possible to determine with reasonable accuracy the point of maximum hyperemia and physiological results, by varying the size of electrodes in treating organs like the kidney, uterus and prostate with the high frequency current. The caustic destructive effect at the needle point is familiar at the positive pole of the galvanic machine and at the needle point of the high frequency machine.

Irritation and counterirritation are generally and successfully provided by the various spark applications and devices consisting really in stimulation. The standard positive pole static brush discharge or Travell positive pole static brush discharge or DeKraft's high frequency effluve or brush discharge are familiar examples. Sparking from the static machine and the high vacuum and condenser discharge glass bulb electrodes are other examples.

Ionization is an old term subject to revision yet to be determined. Upon the skin it is of little or no value, probably on account of the dense, horny layer, but on mucous membranes, especially if diseased as in the deep urethra and uterus, it is of definite value. Zinc and copper electrodes attached to the positive galvanic pole with the distributing pole wrapped about the abdomen will deposit oxychloride of the metal to a depth of about a half centimeter. One must have a list of electropositive and electronegative substances available for ionization because electronegatives, as, for example, iodine, must be applied from the negative pole.

Within the general category of stimulation come the static wave, the galvanic sinusoidal, the Morse wave, and the faradic currents.

These thoughts present the common fact that tests and observation must decide the modality or series of modalities finally employed for a patient because a given

individual may require one modality, another person a different modality and a third two or more modalities illustrated by diathermy-static, diathermy-sine wave, and diathermy-massage combinations. Many others might be mentioned as general principles.

The application of these principles involves congestion, inflammation, abscess, cellular proliferation as in the prostate, cellular destruction as in ulcers, and cellular degeneration as in neoplasms. Each should have brief consideration.

CONGESTION

Gould defines congestion in these words: "An abnormal collection of blood in a part or organ. Congestion may be active or passive, atonic or inflammatory, functional or hypostatic." Probably physical therapy is concerned most with active or passive, and atonic or inflammatory congestion, in each of which the circulation is basically at fault, and to alter which must be its primary aim. This is accomplished chiefly through modes of drawing off the blood directly from the part to surrounding parts and thus restoring the balance. Heat is the means almost *sine qua non*. Hot hydrotherapy applies it by conduction and succeeds only in proportion as the temperature is maintained at a constant level. Light develops heat by convection to the depth of about 1½ inches within the tissues. Its success is great in proportion to the size of the area covered, the duration of the application, and the persistence of the redness of the skin immediately thereafter. Heat by conversion is supplied with reasonable accuracy to any depth between the two electrodes through diathermy, whose physiological results overshadow the patient's sensation of heat or the indication of heat by the thermometer. A current which can be tolerated for thirty minutes without discomfort to the patient is far better than a more massive but brief treatment. Adjuvant to the heat is stimulation of the part, when possible, by mechanotherapy, massage, and passive and active exercise.

INFLAMMATION

According to Gould inflammation is "a condition of nutritive disturbance characterized by hyperemia with proliferation of the cells of a tissue or organ, and attended by one or more of the symptoms of pain, heat, swelling, discoloration and disordered function." The predominant element here is disordered nutrition. Therefore no element of physical therapy can depress the processes of nutrition and succeed. The hyperemia in the affected part must not be augmented but rather relieved by extending the hyperemia to widely surrounding zones and thus making a focal balance in the circulation. If the inflammation flares up the treatment must be changed. The local function as a whole is to be restored to balance and not thrown out of balance. Mild diathermy over as large an area as possible usually decreases the hyperemia in the affected part and the resulting increased arterial blood supply almost invariably restores the nutrition.

The special symptom of pain must never be accentuated. It is commonly due to pressure on the nerves by the swelling and the hyperemia. The more quickly and fully the balance of the blood pressure and heat are restored, the more prompt will be the relief of the pain.

Radiant light from the incandescent or arc lamp is of great value and a reliable substitute for diathermy when the latter irritates because of its transit through and through the part. As yet no one has determined the value of the so-called actinic influences of light in particular and of diathermy in general as to chemical, biochemical and germicidal factors. Improvement in function follows proper treatments. Glands begin to renew their activity. Errors should be on the side of gentleness, exactly as one does not intoxicate a patient with a drug. The relaxation of smooth muscle fiber in a gland by

diathermy and the sedative action of widespread heat through diathermy and of heat through light accomplishes much the same object.

Direct stimulation of the muscularis of a viscus such as the bladder or uterus is usually bad practice until recovery is at hand. Certainly the bladder should always be empty so that the positive contraction induced, for example by the static wave, does not pound against the incompressible urine.

Common sense must be exercised as to the distribution of inflammation, of which orchitis is an example. This lesion is always associated with much rather than little funiculitis, seminal vesiculitis and prostatitis. Hence the author does not consider it good judgment to treat the testicle alone with diathermy, for example. A mesh electrode should be placed on the testicle, a soft metal plate on the groins and pubis, and both connected as one electrode, while a distributing electrode of somewhat larger size is placed under the buttocks. Only in this way can the benefit of diathermy be distributed to all the involved parts as named.

ABSCESS

"Where there is pus, evacuate" is one of the insurmountable rules of surgery, and in physical therapy great caution must be exercised unless there is an outlet for the pus as solvent action begins; otherwise probably dangerous absorption is instituted. Probably the success of diathermy in pneumonia rests on the principle that as soon as the current begins to soften the consolidation, evacuation of the inflammatory product begins and is carried on by expectoration. In general even small quantities of pus had best be left to incision by the surgeon before the application of physical measures, except, perhaps, radiant light and similar measures, which do not pass through and through the accumulation. After drainage has been secured, the manifold influences of diathermy are inviting and satisfactory. Radiant light is of great aid in its actinic, analgesic and stimulating spheres. The roentgen ray, of the form and dose hereinafter described, is an influence of great reliability. Ultraviolet light is said to serve admirably in certain forms of local infection and no doubt has a sphere in its general tonic effect somewhat like that of sunlight.

CELLULAR PROLIFERATION

The term cellular proliferation is used as a substitute for fibrosis in viscera such as the prostate and uterus. I am extremely doubtful whether any form of physical therapy has any direct influence on these changes unless it is the roentgen ray. It is certain that this modality will check hemorrhage from both of these organs and compel a variable degree and sometimes a high degree of restitution of parts. Occasionally one sees fibroids of the uterus totally disappear. When a prostate, however, decreases under its influence, it is by a process of condensation, so that the resulting gland is almost a cicatrix. Hence, if the obstruction within the urethra is not correspondingly removed, an operation becomes more and more urgent and difficult on account of the dense tissue left behind. The whole process is so slow that cystitis and ascending ureteral and renal involvement may appear so far ahead of beneficial results as to nullify them. Hence I am of the most positive opinion that no prostatic work should be undertaken except with the guidance of a cystoscope in the hands of an expert urologist.

In all this work the quality of the roentgen ray becomes important. Fortunately the majority of the professional public is unlearning the mistake of the "mass-and-flash" dose of roentgen ray which has beguiled the experts for over ten years. By the term "mass-dose" I mean the ultimate quantity and quality of current that may still be called safe, and by the term "flash-dose" is meant an application so brief that burning of the skin is impossible.

The crux of roentgen-ray work seems to be milliampere-minutes. Beyond question a 50, 60 or 70 ma. m. dose of high voltage but low amperage and of long rather than short application is the method to be preferred, because it does not damage the normal parts while it does destroy the diseased parts which are much more vulnerable to it. This is the method of roentgen-ray application which I have never forsaken, notwithstanding the enthusiasm of many others for the "mass-and-flash dose." As I have elsewhere said:[1]

"The *x*-ray is stimulating or inhibiting according to dose. The stimulating dose causes hyperemia and cell action while the inhibiting dose produces tissue contraction and cell decline. These are the bases of action in prostatic cases. Hemorrhage may be controlled with the *x*-ray. The source may be the static machine or the transformer. The static machine seems to have the advantage of about 127,000 volts when the standard ball terminals (0.866 inch in diameter) are 15 cm. apart according to Harris and Reiss, both noted and independent investigators. Such voltage gives greater penetration than that from a transformer, having greater amperage but lower voltage. *X*-ray treatment with the static machine for thirty minutes at 2 to 2.5 milliamperes, thus delivering seventy or seventy-five milliampere minutes, may be more serviceable than treatment by a transformer delivering 10 milliamperes for two to two and a half minutes, in total 20 to 25 milliampere minutes under considerably lower voltage and lower penetration but higher burning powers. This comparison is probable but is still under study. The *x*-ray tube vacuum should back up a five-inch spark gap between the ball terminals. This gap is equal to a ten-inch distance between the pointed terminals of the transformer machines. A transformer with standard ball terminals will deliver about the same voltage but the higher amperage is almost sure to burn the patient. Burns with the static machine are rare, when compared with remarkable results."

CELLULAR DESTRUCTION

In Gould's dictionary the brief definition of ulcer is: "A destructive loss of cutaneous substance extending into the coreum." This is an example of the difficulty of creating an inclusive and exclusive definition. Only ulcers of the skin are included in these words, whereas ulcers of the internal surfaces are universally under treatment. Nevertheless, ulcers of the skin are chiefly those under direct treatment by physical therapy. The indications are to clean the surface in a surgical sense and to promote healing by suitable stimulation. Any of the ordinary modern wet dressings may be systematically and carefully employed. Ultraviolet light in a stimulating dose at a distance of 30 inches for four or five minutes, gradually increased to 18 inches for from five to twenty minutes, is of great value and will not burn or irritate under these details. The air-cooled instrument is preferred. Stimulating doses of roentgen ray every three to five days are very valuable. Débridement of the unhealthy indolent tissue down to healthy granulating tissue is undoubtedly the first indication, a very sound surgical principle and one which the average electrotherapist must follow. Circulatory and lymphatic return are aided by elevation of the part, deep muscular massage, and proper bandaging. Radiant light from the incandescent lamp and the carbon arc, static brush discharge from the positive pole (Travell's method) or the high-frequency effluve (DeKraft's technique) are all of great value. Zinc ionization may be used once a week.

The normal indolence of ulcers means that the results of such treatment are slow.

CELLULAR DEGENERATION

No definition of cancer can be attempted, but cellular degeneration both in overgrowth and in death is certainly an inclusive term although it is not directly exclusive and must answer the purposes of a paper of this character. Physical

therapy offers radium and the roentgen ray. To the disadvantage of radium is its high cost, difficulty of acquisition, and above all local or limited action. These are the reasons why I have never used radium. The roentgen ray, on the other hand, performs all the functions of radium, is very easy of acquisition, and has a widely distributive action exactly into the zones where most needed. These are the earliest possible extensions along the vascular and lymphatic channels and by contiguity into other parts of the organ or tissue involved. The roentgen-ray dose may be fully controlled, definitely distributed, deliberately transferred, for example, from the pelvic to the abdominal region, as exemplified in the kidney, ureteral, general abdominal and general pelvic areas. The reasons for preference for fractional roentgen-ray dose over the mass-and-flash dose have just been described. The notable work of W. L. Clark[3] and G. A. Wyeth[4] has demonstrated beyond question the value of the high-frequency current through a needle applied at, in and around the offending growth, with a distributing electrode on the opposite side of the body under a milliamperage of about 2000. Desiccation is produced by the milder currents of this type applied to superficial conditions. Coagulation is the next step produced by increasing the current, and finally carbonization is the last stage reached through the extreme of current.

In my opinion control of the current under the eye by a spark gap is of much more importance than meter readings.

In a special research, Cunningham, Graves and Bovie[5] believe that they have established an accurate control technique. This article was sent to the expert of one of the leading manufacturers who has written to me as follows: "From the paper I cannot see in what manner they control. However, they are showing how they indicate the heat on a meter. How they can claim an improvement in the method of destroying tumors is not obvious, and I doubt very much that they have come any nearer to a good method of curing cancer of the bladder. It does not make any difference what kind of an electrode is used, whether they screw it in or jab it in, or whether they use plates." This authority then goes on to point out the danger of absorption from decomposed cancer substance, the necessity of very active elimination, and the value of such physical methods as the sinusoidal current for promoting this elimination. It is interesting to note that this layman learned these important things at a European Congress a short time before his letter was written.

My opinions on these points are very aptly set forth in the following abstract from a recent paper. Sloughing tissue with or without bacteria is a source of toxic absorption of unknown quality, degree and termination. War experience developed our new definition of shock: "traumatic intoxication." A tourniquet placed on the thigh for an extensive injury of the leg prevented said absorption and shock until removed, unless the sloughing mass was freely removed down to healthy tissue. How much more must such poisoning arise when drainage as in the bladder and its environs cannot be adequately provided. Undoubtedly widespread coagulation of bladder tumors through so-called surgical diathermy is no longer good surgery or electrotherapy. The index of the thermometer is of little value. The dead mass must not be left in situ because death is so apt to supervene from the albuminoid poisoning. Débridement of the slough produced by the currents is as necessary in the bladder, as débridement is essential in gunshot and other war wounds. "All consideration and judgment in these cases are the reasons why the writer has never used this form of mass coagulation of cancer of the bladder and has never relied on the thermometer as the best index. Apparently the method which he has always preferred is just beginning to be applied systematically by urologists."[6]

The technique I prefer is as follows: Under sacral and parasacral anesthesia,

suprapubic cystotomy is centered over the general mass of the tumor, the bladder mobilized and freely retracted. The balance of the technique is described in the foregoing article thus: "Electrocoagulation is employed using the damped high-frequency current of such potential that the superficial layers of the growth are carbonized, the next layer densely coagulated and the deepest layer slightly coagulated. A sixty square-inch metal electrode is placed under the buttocks well soaped for perfect contact and the hand-electrode is a well-insulated copper electrode brought to a sharp point. An air-gap of about one-quarter inch is maintained between the point and the growth not only to intensify the spark but also to keep every step of the work directly under the eye. No thermometer to determine the thermometric heat is at any time employed. As soon as the surface of the growth is carbonized in this way all the tissue is carefully removed with a sharp rongeur to minimize the traumatism of the cancer and then another field of electrocoagulation developed and removed. These steps are repeated until every vestige of the growth is gone as far as naked eye and finger can determine. The growth is usually so situated that the only other operation which can be thought of is transplantation of the ureters and removal of the whole bladder and prostate which the patient rarely survives and which remotely would not benefit him because the situation of the cancer and its traumatism by the action of the bladder extend the growth far into the lymphatics beyond the reach of any surgery. Therefore any operation including the one performed must conform to the temporary and palliative type as duly explained to and accepted by the family physician."

Roentgen ray is employed by the crossfire divided dose method for at least six treatments before the operation and six treatments after the operation. At the end of three, four and six months after the operation other courses of roentgen-ray treatment are given in order to prevent as far as possible any secondary deposit.

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PHYSICAL THERAPY

IN MEDICINE AND SURGERY*

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THE subject of physical therapy has gone through a period of intensive investigation since the latter days of the War, and consequently much of the mysticism and many of the supposedly superhuman reactions caused by treatments with the modalities included under this head have been explained and exposed. We no longer consider it a very deep subject because we know all the reactions are governed by unalterable laws of physics and physiology. As an instance of this fact I might mention that most of the treatments in physical therapy today are not administered by the physicians themselves but by lay technicians especially trained in the handling of the machines we use. They do not presume to know enough medicine to treat diseases, except as directed by the physicians in charge of the hospital departments or offices in which they work. Such a method of administering any other forms of treatment could never be resorted to in the procedures we class under the head of surgery, medicine, gynecology, etc.

We use the physical measures included under the term physical therapy only in an effort to convert an inadequate physiological reaction in the body into one that is adequate to overcome the pathological process. In our use of physical forces, we can bring about only three reactions in a physiological way, and we have to depend upon the actions of these results of physical therapy in our effort to help the patient overcome the condition presented.

The three reactions we can produce in the body are the formation of heat where and to what degree we want, the effects of mechanical motion or exercise, and some weak but potent chemical reactions. That is all physical therapy does: it produces heat, produces more motion than the body itself is capable of exerting in certain locations, and produces chemical reactions that sometimes are of distinct benefit to the body. I endeavored to explain these fundamental reactions more fully in a paper presented before the American Hospital Association.[1]

It is always a good thing to give all the definitions possible when presenting a subject. I can give a definition of physical therapy which, although not absolutely certain, is approximately an evaluation in percentages. As in all therapeutics, the medical training and common sense of the physician are by far the greatest factors. I believe that fully 95 per cent of physical therapy is a correct understanding of physiology and pathology. This is the presumed equipment of successful physicians and surgeons today. Of the remaining 5 per cent of physical therapy, perhaps 2 per cent is an understanding of the three primary reactions that I have already cited. The final 3 per cent of physical therapy is the technical knowledge of applying the different modalities in the most convenient and rational way. We physicians who apply physical therapy must have this 3 per cent, but others who might choose to give patients the benefit of physical therapy do not need it. It is this 3 per cent only that we desire our technicians or non-medical assistants to acquire, because theirs is rather a routine procedure whereby they apply the prescribed modalities. These technicians and those of us who practice physical therapy are

[1] Titus, N. E. What is physical therapy? *Mod. Hosp.*, Chicago, Dec., 1926, xxvii, 54.

* Read before the Bedford Medical Society, Brooklyn, N. Y., December 14, 1926.

related to the medical profession in much the same way that pharmacists are, except that we actually give the doses of physical forces, following out in many cases the prescriptions ordered by the physicians in charge, while pharmacists only compound the prescriptions and hand the bottles to the patients to take as prescribed.

Therefore, in presenting the subject of physical therapy as a means of more successfully carrying out general practice or specialized branches of general medicine, I want to emphasize that you already have 95 per cent of the subject. I wish merely to supply the other 2 per cent; and perhaps in discussion I can help those who wish to apply the modalities to acquire what they need of the remaining 3 per cent.

It is extremely difficult to lay down the exact technique of administration for certain diseases or pathological conditions that present themselves in our patients. I cannot give full assurances that the technique I describe will be absolutely correct, nor must it be entirely depended upon because merely through practice I have acquired techniques that may to others seem unnecessary. Since all of us have 95 per cent of this subject, general reasoning and understanding of the physiology and pathology may cause individuals to originate techniques of their own. There are no standardized techniques and I shall be very interested to see a proposed publication by the American Medical Association wherein will be described standardized techniques for different treatments. I only hope that it will be published as "a guide to technique," including specially designated standardized steps.

Before going into specific diseases it is necessary to present a few facts in physics and physiology that are in a way quite necessary to an understanding of why I may suggest certain forms of treatment in contradistinction to others. When we choose to produce heat within the body we have available two extremely potent methods. It has been proved that radiant light from an incandescent bulb is capable of forming heat at different layers beneath the skin in the living body to a depth of about 1½ in. One can fully appreciate that this is possible if he will stop to think of the old law of the conservation of energy which emphasizes the fact that energy in motion, when stopped, becomes heat. If we can make light energy penetrate through 1 7/16 in. of skin, as was proved by Kinney some years ago, we know that the amount of light which does not get through the tissue but strikes the skin on the outside is stopped within the tissues of the body, and light, being energy in motion, forms heat at the levels where the motion is arrested.

There is no other means available in therapeutics except electricity that will form heat beneath the skin. Mustard plasters, flaxseed poultices and even actual cautery do not cause any particular heating of the tissues beneath the vascular layer of true skin. Let me cite one experiment performed by Dr. Karl Sonne of the Finsen Medical Light Institute of Copenhagen. He placed thermopiles in the deep veins of the upper arm and on exposing the forearm to light energy was able to prove that the blood coming from the forearm was heated to 115°F. Think of the potency of such a method of forming heat in tissues. If you choose to be experimental in your consideration of these things, try radiant light on an acute myositis or on a pleurisy and see the great relief that you give to your patients.

The other means of producing heat in tissues is with the use of high frequency electricity. Years ago d'Arsonval discovered that an electrical current passing through living tissues alternating at a frequency of greater than 5000 per second did not produce any electrical, nervous or physiological response in the tissues traversed. He did observe, however, that the tissues placed between the electrodes acted as a distinct resistance to the current, and we all know that a resistance in an electrical circuit causes the formation of

heat in this resistance. Therefore with high frequency electricity, probably more commonly known as diathermy, we have a means of producing heat at any depth in the tissues and to any degree we wish by merely interposing the tissues in a circuit through which the high frequency current passes. Contrary to a recent dictum that has been getting widespread attention, diathermy does not cause the production within tissues of heat that then comes to the surface; the heat is formed in the living tissues throughout the entire interelectrode path. I grant that the heat is generally more effective in a circumscribed locality in this interelectrode path, but this is merely because Nature has endowed us with such protective faculties that we are able to dissipate a great deal of heat generated in the path between the electrodes, so that the point of maximum intensity causes a greater physiological effect merely through the action of the body and not through any peculiar reaction of the electrical current itself.

To produce mechanical reactions we have a very valuable method, and that is by massage and exercise. Had the medical profession years ago not believed that massage was too unprofessional for them to direct or administer, we would not today have the foolish competition to our decent methods of treatment, from chiropractors and other rubbing cults. They are capitalizing the fact that massage and exercise can produce some results even though the members of these cults are too ill informed to appreciate the indications and contraindications. The more we use massage and exercise, rationally directed by competent operators, the greater respect physical therapeutists have for this method of treatment. I shall speak of its particular use later.

The other method of inducing mechanical effects is the use of static electricity. This is a current of extremely high voltage or pressure and extremely low amperage or volume, and consequently when we work with a force under such high pressure we can bring about mechanical effects produced by pressure. Static electricity always has been used for therapeutic purposes and was the original electrical current. It is coming back into its own, now that we have a more scientific understanding of the subject, and I would no more regard as well equipped a department of physical therapy without a static machine than I would claim an automobile was perfect without a full set of wheels.

Concerning the chemical reactions that we can produce, we are learning almost daily of the very beneficial effects that are obtained by the administration of ultraviolet light. We are getting to know more and more about this wonderful modality. One of its most potent effects is its influence upon phosphorus and calcium metabolism in the treatment of rickets and tetany. Of course there are some chemical reactions induced by the galvanic current but these are extremely weak and have a limited field of usefulness. It is not my desire to go into great detail concerning these modalities nor have I thought to give any special mention to hydrotherapy or thermotherapy, which are quite analogous in the reactions they induce.

Let me now sketch a few of the conditions that present themselves to the general practitioner and the way we might consider these diseases properly treated if we make use of this added tool in our armamentarium, namely, physical therapy.

First of all, in diseases of the nervous system, paralysis and injuries to peripheral nerves respond more readily to interrupted galvanism and static electricity than any other means available. Herpes has practically no regular medical treatment but can be distinctly benefited by the use of ultraviolet light and static electricity. Neuritis, either brachial or sciatic, is considered by many to be a secondary symptom caused by a myositis either of the infraspinatus or gluteal muscles, and if we treat these muscles as though they had a true myositis, with light or diathermy according to the location, *followed*

by static electricity, we can generally count upon a good result.

Some writers have dwelt on the efficiency of physical therapy in the treatment of tabes dorsalis, but beyond very temporary relief from the girdle pains, I am sure we can do nothing that will benefit this condition.

In disorders of the skeletal muscles, such as myositis, contusions and ruptures, we have for the first two conditions almost specific remedies in light and static electricity. Where there is a rupture of the muscle we do not care to increase the tear and consequently very mild massage or hydrotherapy has a better effect.

Circulatory diseases present many different conditions, some of which react well to physical therapy while others are entirely unaffected. In the treatment of hypertension, high frequency electricity administered as autocondensation really has a good result in relieving the patient of symptoms and it generally can be counted upon to reduce the pressure, which frequently is necessary in the general medical management of the patient. If the hypertension has gone on to apoplexy, the use of galvanism and high frequency electricity through the brain very frequently hastens a resolution of the condition and quickens the restitution of function of the peripheral parts affected.

Some writers claim great effects from high frequency in sclerotic conditions of arteries and in angina pectoris. I cannot give any definite experiments in the treatment of these conditions because, having been trained as a medical man, I have always felt that even though medical treatments are not particularly efficacious it is probably best not to tamper with Nature and create a disturbance that might hurry the patient's death. Radiant light alone has great effect on phlebitis. The destruction of telangiectases with high frequency is a satisfying procedure. Ecchymoses and varicose ulcers respond particularly well to the static current when administered as an effluve.

In respiratory conditions I know of no medicinal remedy that will give the relief that diathermy will when administered through the chest. This applies to bronchitis, both acute and chronic, pneumonia and even asthma. I do not believe there is any specific action of the high frequency current on the pneumococci but when we produce heat within the tissues by means of diathermy, the body will always attempt to dissipate the heat by forming a physiological hyperemia. I am of the opinion that it is the induction of this hyperemia that gives the patient relief and possibly an increased resistance to the infection.

There are few gastrointestinal conditions in which physical therapy can be of service. It is very probable that a few cases of slight inflammation of the gall bladder or appendix may be benefited by the physiological hyperemia above referred to and induced by means of diathermy. However, I still believe that a troublesome appendix is always a menace until it is removed and I am always loathe to attempt treatment of such conditions with physical therapy. Consequently my experience in the possible benefit referred to in some of the overenthusiastic literature is very limited. There are hyperenthusiasts who claim that the counterirritation produced by large doses of ultraviolet light have a beneficial effect upon gastric ulcers. This is open to question. I do, however, feel that the use of low voltage wave currents is a particularly efficacious means of overcoming intestinal atony and it is surprising to see how soon many chronically constipated patients will respond to a course of treatments with this kind of current and, with slight cooperation, are able to overcome their constipation.

Diseases of the urinary system, especially those from the bladder up that are purely medical, frequently are helped by the induction of a hyperemia such as we can effect with diathermy.

Kolischer[1] has written on the treatment

[1] Kolischer, G. Diathermy in medical kidney disease. *Arch. Physiotherap., X-Ray, Radium*, Omaha, Oct., 1926, vii, 601.

of different forms of nephritis with diathermy. Cystitis is frequently helped by diathermy; and infections of the prostate, when mild, can be benefited by this same modality. In so-called hypertrophy of the prostate, static electricity is particularly beneficial and it is surprising to see how soon the polyuria is overcome.

I shall not dwell upon the treatment of gonococcal infections with diathermy. Cumberbatch, of St. Bartholomew's Hospital, London, has written a book on the subject of these conditions in women that is particularly instructive, and the technique of his treatments is not very difficult to comprehend or to master. In cases of gonococcal infection in the male, physical therapy, and more particularly diathermy, have been most disappointing. Cherry of New York reports successful treatments of pyosalpingitis with diathermy.

In malpositions of the uterus the low voltage wave currents are very effective but I think the static current is more so. Both stimulate the muscle of this organ and help it to assume its normal position in a physiological way. I might also mention that there is no treatment I have heard of for subinvolution that can produce as good results as static electricity. Infantile uteri can be stimulated to normal growth, it is claimed, by the use of the galvanic current and one may perform curettage of the cervical endometrium with positive galvanism without hospitalization.

Physical therapy is of distinct help to surgeons and in the regular treatment of fractures there is nothing that helps the patient to return to his work like the judicious use of massage and exercise during the healing and postsurgical stages. Radiant light is of great service in the treatment of burns.

[SURGICAL SUGGESTIONS]

THE advantages of approaching a femoral hernia from above, i.e., through the inguinal canal, have been much exaggerated. Attacked from below, the sac may be tied off so high that the stump recedes well within the abdomen; and sutures approaching Poupart's ligament to Gimbernat's and to the pectineus fascia can be put in the same place as by the inguinal route. The latter operation, while not at all difficult, is more complicated and runs the risk of weakening the inguinal canal.

A SICKLE-SHAPED incision curving downward medial to the protrusion is a convenient one for approaching a femoral hernia.

IODINE HYPERTHYROIDISM*

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DURING the past decade two remarkable advances have been made in checking the progress of goiter, and it is significant that these achievements have been accomplished in our own country. It is an indication of the forward trend of America in the field of medical science. Our colleagues are awaking to the goiter menace, and the problem is no longer of merely local, but of national interest. The East and the Far West have joined the Central States in the study of this question.

The splendid work of Marine, Lenhart and Kimball in formulating an organized plan of goiter prevention and of Plummer in proving beyond a doubt the value of iodine in the treatment of exophthalmic goiter is a tribute to American medicine. While the value of iodine in the therapy of goiter has long been recognized, the literature did not contain sufficient data to warrant its present usage until these workers brought forth their ideas.

Iodine was in such popular vogue in the treatment of goiter during the latter part of the past century that occasional harmful effects were noticed. As a result Kocher called attention to this danger and warned against the promiscuous use of iodine in the care of goiter. Because in many ways the harmful effects simulated exophthalmic goiter or Basedow's disease, Breuer called this syndrome iodine-Basedow. The warning of various observers against the use of iodine, and the erroneous association of hyperthyroidism induced by iodine with the clinical picture of exophthalmic goiter, resulted in a widespread fear of the employment of iodine in the latter condition. A study of the literature reveals the reports of many supposed cases of exophthalmic goiter brought about through the misuse of iodine. Even today this view is upheld in many European countries.

This misconception retarded the discovery of a valuable therapeutic measure. So firmly fixed was the idea that only six years ago the use of iodine as a skin antiseptic preparatory to operation was abandoned in several of our large surgical clinics. In 1924 I reported a series of 18 cases in which hyperthyroidism had developed in non-toxic adenomas of the thyroid, after the indiscriminate use of iodine. Since this condition was always associated with adenomatous goiter, I felt that the term "iodine-Basedow" was misleading, as we consider Basedow's or Graves' disease as exophthalmic goiter. Inasmuch as the pathological picture and the clinical findings were markedly different from exophthalmic goiter, these two toxic conditions could not be placed in the same classification.

In 1913 Plummer and Wilson clearly differentiated between the clinical and pathological findings of exophthalmic goiter and of toxic adenoma. This differentiation, while not generally accepted, is rapidly gaining recognition in this country and abroad. Thus Plummer recognizes two toxic forms of goiter, exophthalmic and multiple toxic adenoma, or adenoma with hyperthyroidism. To the committee on nomenclature I wish to present for their approval a further differentiation of toxic goiter, and suggest the following classification:

Non-Toxic	Toxic
1. Colloid	1. Exophthalmic
2. Adenoma	2. Adenoma
	a. Toxic
	b. Iodine hyperthyroidism

*Read at the Annual Meeting of the American Association for the Study of Goiter, Philadelphia, January 31, 1927.

It has seemed to me that the term iodine hyperthyroidism is appropriate because this is a form of hyperthyroidism induced in a previously non-toxic adenomatous goiter by the indiscriminate use of iodine. This condition cannot truly be termed iodine-Basedow for reasons previously stated, nor can it be classified as merely toxic adenoma. Recently I reported a series of 50 cases of iodine hyperthyroidism in which the clinical symptoms were shown to differ clearly from those of toxic adenoma. This work has received the support of several clinicians in this country, notably Kimball, who has reported a large series of cases. When this subject was presented at the 1925 alumni meeting of the Mayo Foundation, Plummer was willing neither to accept nor reject the recognition of iodine hyperthyroidism as a distinct clinical entity.

I believe that toxic adenoma as described by Plummer does not exist in persons under thirty years of age. In the group of cases here discussed, many of the patients are under thirty years of age. Everyone of these gave a history of having a non-toxic adenomatous goiter until hyperthyroidism developed from the use of iodine. Cases of exophthalmic goiter in which multiple adenomas are associated may be commonly observed and need no discussion.

The characteristic symptoms indicating that iodine hyperthyroidism should be distinctly separated from exophthalmic goiter and toxic adenoma may be summarized as follows: this syndrome occurs only in persons with adenomatous goiters, and although it may develop in children or the aged, it appears at an average of thirty-seven years. In this respect it simulates exophthalmic goiter. Likewise, tremor, nervousness, loss of weight, tachycardia, loss of strength and insomnia occur as in the other forms of hyperthyroidism. The onset of symptoms also resembles that of exophthalmic goiter because of its short duration, averaging about four months. There is a peculiar type of restlessness and nervousness suggesting this disease, but in severe cases these symptoms are more marked. The patient gives little or no cooperation, and the condition progresses to actual delirium. There may be a rapid loss of weight as in exophthalmic goiter, but the characteristic ravenous appetite is never seen. Two patients in this group lost more than 50 pounds in two months. In none was the presence of thrills or bruits noticed, a symptom of great diagnostic importance in Graves' disease. In the latter condition the finding of a normal or slightly elevated systolic pressure and a low diastolic pressure is of considerable significance. Toxic adenoma is characterized by a hypertension and a proportionately high diastolic pressure. The blood pressure findings in iodine hyperthyroidism are not of diagnostic value. The systolic pressure may be considerably elevated, a low diastolic pressure is not seen. Tachycardia is synonomous with toxic goiter. In iodine hyperthyroidism, the pulse rate is often extremely rapid, and the cardiac pulsations such as to give an impulse to the entire body. Digitalis is of little value in slowing the pulse. Exophthalmos has never been observed in these cases.

In toxic adenoma there is a gradual onset of symptoms of several years' duration before the patient comes to operation, in contrast to the rapid onset of symptoms as noted in the other two forms of toxic goiter. In exophthalmic goiter, hyperthyroidism develops by a series of waves of increasing severity followed by periods of remission, in toxic adenoma there is a slow steady progress of the disease, in iodine hyperthyroidism there is a rapid onset, the duration and severity depending partly upon the dosage of iodine. Toxic adenoma is a steadily progressing condition, whose course can only be checked by surgical removal of the goiter. Early cases of iodine hyperthyroidism may be aborted by prompt withdrawal of the drug and the institution of the proper medical measures. Once the disease has advanced surgery alone can effect a cure. One case resisted all medical

MEDICAL AND SURGICAL RESULTS IN TREATMENT OF IODINE HYPERTHYROIDISM

Case No.	Sex	Age	Iodine, months	Prescribed by	Basal metabolic rate per cent	Loss in weight, pounds	Treatment	Basal metabolic rate on discharge per cent	Gain in weight
32444	F.	65	3	Physician	+29	10	Thyroidectomy	+5	40
32860	F.	28	5	Physician	+17	12	Thyroidectomy	+1	24
31732	F.	30	2	Physician	+20	25	Thyroidectomy	+4	8
29894	F.	36	3	Physician	+44	29	Thyroidectomy	+10	25
35220	F.	27	3	Surgeon	+22	15	Medical	+4	5
33663	F.	53	2	Physician	+29	30	Thyroidectomy	+0	50
33275	F.	23	2	Internist	+16	8	Thyroidectomy	+4	14
34808	F.	35	2½	Quack remedy	+31	13	Thyroidectomy	+8	22
29598	F.	50	3½	Specialist	+46	15	Thyroidectomy	+4	18
34592	F.	32	4	Quack remedy	+24	10	Medical	+8	12
35087	F.	40	3	Physician	+18	30	Thyroidectomy	+4	16
35365	F.	52	4	Physician	+51	50	Thyroidectomy	+5	51
35280	F.	52	3	Physician	+30	25	Thyroidectomy	+6	24
35351	F.	35	2	Quack remedy	+26	14	Thyroidectomy	+3	20
36687	F.	38	4	Physician	+28	8	Thyroidectomy	+5	20
36589	F.	28	3	Physician	+28	10	Thyroidectomy	+5	13
38914	F.	22	3	Physician	+30	10	Thyroidectomy	+6	10
40173	F.	47	2½	Physician	+52	13	Thyroidectomy	+10	25
39915	F.	45	3	Physician	+55	13	Thyroidectomy	+0	10
42044	M.	64	3	Quack remedy	+67	51	Thyroidectomy	+8	42
42282	F.	38	4	Physician	Too sick	53	Thyroidectomy	Died	
42959	F.	49	4½	Physician	+62	35	Medical	Died	
39042	F.	27	8	Quack remedy	+47	13	Thyroidectomy	+2	13
39419	F.	30	2	Druggist	None	5	Medical	——	—
39882	F.	30	12	Physician	+40	0	Thyroidectomy	+0	15
41177	F.	41	1	Physician	+20	10	Thyroidectomy	+3	10
41288	F.	39	2	Physician	+25	0	Thyroidectomy	−3	5
40064	F.	49	1	Physician	+18	18	Thyroidectomy	−8	30
30262	F.	27	2	Relative	+57	15	Thyroidectomy	+3	9
41412	F.	14	3	Physician	+24	10	Thyroidectomy	0	16
27035	F.	36	3	Physician	+24	6	Thyroidectomy	+7	5
41278	F.	25	4	Physician	+28	8	Thyroidectomy	+4	6
40586	F.	14	3	Quack remedy	+46	20	Thyroidectomy	+11	25
31596	F.	16	8	Author	+21	6	Medical	+5	6
31106	F.	38	12	Physician	+46	20	Thyroidectomy	+7	30
38730	F.	27	2	Physician	+18	5	Medical	——	—
34973	F.	24	3	Physician	+17	No	Medical	——	—
43804	F.	48	3	Physician	+43	30	Thyroidectomy	+10	20
43842	F.	56	4	Physician	+26	15	Thyroidectomy	+3	—
44234	F.	46	3	Physician	+20	46	Medical	——	—
44406	M.	66	12	Quack remedy	+19	45	Medical	+5	15
45403	F.	54	6	Physician	+35	73	Thyroidectomy	——	40
45250	F.	29	6	Physician	+28	17	Thyroidectomy	+17	25
44680	F.	47	7	Physician	+60	30	Thyroidectomy	0	1
44301	F.	17	7	Physician	+44	25	Thyroidectomy	+2	22
46670	F.	23	3	Physician	+38	7	Thyroidectomy	+3	11
40704	F.	23		Physician	+17	No	Thyroidectomy	+5	12
46654	F.	12	3	Physician	+25	14	Medical	——	—
45429	F.	39	7	Quack remedy	+23	15	Thyroidectomy	0	—
35704	F.	65	6	Physician	Too sick	35	Medical	Died	
50487	F.	51	12	Physician	+41	21	Thyroidectomy	+13	1
18389	M.	48	6	Physician	+34	20	Thyroidectomy	+6	—
48724	F.	23	6	Physician	+18	3	Medical	——	—
35367	F.	35	5	Physician	+41	25	Thyroidectomy	+6	41
Averages		37	4		+33	21		+5	19

treatment, could not be operated upon, and the patient died three days after admittance. Three cases have terminated fatally, one following an attempt at surgical relief.

A study of the basal metabolic rate of these patients showed an average of plus 33 per cent as compared with plus 29 per cent in a group of cases of toxic adenoma and plus 54 per cent in a series of cases of exophthalmic goiter.

The great awakening of interest that has been developed in the prevention and treatment of goiter by Marine, Kimball and Plummer should likewise carry with it a note of warning. I have always maintained and am continuing to do so, that iodine is a drug and not a food and should consequently be administered not under the direction of grocerymen but of physicians. Moreover, there is still some doubt in my mind as to the actual effectiveness of iodine in the prevention and treatment of goiter. I have been studying a considerable group of children for several years, and while I am not prepared to enter into a discussion of the subject at this time, I can say that the results obtained in the actual treatment of colloid goiter with iodine have been disappointing. Without attempting to reflect in any way upon the splendid achievement or hinder the work that has been done, I believe that we should concentrate upon a safe and sane plan of prevention, while seeking further for more satisfactory methods of treatment. The promiscuous sale and distribution of iodine should be discouraged. Patent medicines were responsible for 7 of the cases in this series. Eight were patients of the same physician. Lugol's solution of iodine caused 6 of the cases including the 3 that terminated fatally.

Space will not permit a discussion of the pathology or of the treatment and prognosis. Three of the patients here reported were cured by medical means; 3 died in spite of all forms of treatment; the remainder were cured by thyroidectomy. The mortality was considerably higher than in a similar number of cases of exophthalmic goiter and toxic adenoma. All the patients in this series that responded to treatment made a good recovery.

To the cases reported in a previous paper I wish to add 4, making a total of 54.

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SOME COMPLICATIONS & THEIR PREVENTION IN GOITER SURGERY*

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PROBABLY in no branch of surgery is it more important to realize fully the complications and undesirable, sometimes disastrous, sequelae that may follow operation than in surgery of the thyroid gland. To avoid these, a thorough knowledge of the present conception of its diseases and their surgical treatment is paramount. Operations on the thyroid gland for goiter in some form, more particularly the severe types of hyperthyroidism, open the door for complications which when they occur sometimes at least should have been prevented. Many of these complications can be prevented if we answer correctly the following two questions:

1. When shall we operate (including the preparation of the patient)?

2. What shall we do (including the technique of the operation)?

The period of time in the patient's disease chosen for operation is one of the most important steps in the management of hyperthyroidism. In exophthalmic goiter if the patient is seen within the first few months of the disease, before iodine in some form has been administered carelessly over an indefinite period of time, the patient in question will usually be in good condition for operation in from seven to twenty days by the use of Lugol's solution, rest and proper feeding. The improvement which follows such treatment so consistently must not be overlooked as this is the time to undertake operative procedures which usually can be carried out very safely indeed. Unfortunately, many cases of this disease have undergone iodine administration for weeks or months in other hands and have passed the period of improvement during which operative measures should have been carried out. The condition of this type of case having become aggravated by the prolonged use of the drug fails to respond to its further use.

I would like to make a plea for the more rational use of iodine in the treatment of exophthalmic goiter and to suggest that until surgical treatment has been decided upon the drug should not be used in this disease.

For more than two years I have been using Lugol's solution in the preoperative care of toxic adenomas; and I[1] have found that five to ten minims of this drug twice daily for five to ten days before operation seem to aid considerably in the improvement of the patient who, I feel, withstands operation better than without its use. These findings have been borne out by Graham.[2]

Operation late in the disease is a factor which weighs heavily in favor of complications and unsatisfactory late results. It is in such cases as these that we find diseased and enlarged hearts often accompanying massive vascular goiters, a bad combination, which means a big operation often technically difficult on a patient with a heart quite unfitted to resist the extra strain entailed, accompanying as it does the many other grave disorders characteristic of this disease. These are the cases which tend to swell one's mortality rate and which, it must be recognized, should have been operated on much earlier in the disease. The fault is not always the

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patients', as in some instances they have been carried for months or years under some form of treatment or observation by physicians, being advised to seek surgical treatment only after they have gradually drifted into a critical condition. It might be said by some that patients presenting themselves with large goiters, marked enlargement of the heart, often fibrillating, tachycardia and manifestations of failing circulation, marked loss of weight, high basal metabolic rate, etc., should be refused operation. If we analyze such a statement by our experience we will find, I think, that such advice is not sound. We know that most of such cases if not relieved of the goiter will steadily go down, often dying of congestive heart failure, whereas many such cases in the past have been successfully operated on and have made very satisfactory recoveries to such an extent as to be able to resume their previous occupations. These "bad risk" cases need careful handling often over a long period of time, for surgery cannot withhold what it has to offer, even if such practice entails an increase in operative mortality.

Let us suppose that in a series of 200 consecutive thyroidectomies we find 20 such "bad risk" cases. It is very probable that the deaths will be found among the last group mentioned. If the surgeon loses 4 or 5 or even more of these (an average mortality of 2 per cent to 2.5 per cent) he is to be commended much above the surgeon who refused to operate on the 20 bad cases but did the remaining 180 cases without a death. In such an example as this, the latter surgeon's mortality should be based on the end-results of the cases he refused to consider surgical.

The answer to all this is early operation, and to this end the medical profession should be taught the danger of procrastination of an indefinite character in all cases of hyperthyroidism, whether primary or secondary.

The postoperative morbidity in the form of an incomplete cure depends chiefly on two factors:

1. The duration of the disease before operation.

2. The amount of diseased tissue removed at operation.

All forms of hyperthyroidism enjoy a more complete cure the earlier they are operated upon. Radical resection of the goiter, more particularly in the exophthalmic type, predisposes to early and complete cure.

A note of warning might be sounded in the extremely radical operation for exophthalmic goiter where Lugol's solution has been administered before operation. Cattell,[3] Reinhoff,[4] and I[1] have shown that when Lugol's solution is administered in exophthalmic goiter there is a reversion of the gland to a form more of the colloid type of goiter. This being the case, it follows that a given amount of thyroid tissue would be less potent after the use of iodine therapy than before and for this reason probably a slightly less radical operation should be done on lugolized cases than on cases not so treated. In my earlier experience with Lugol's solution, I performed my usual quite radical operation and found in a number of cases that the patient swung from a severe degree of hyperthyroidism before operation to a definite degree of hypothyroidism a few weeks after operation. In each case, however, the thyroid function gradually became balanced some months later. Since this experience, however, I have endeavored in such cases to leave slightly more thyroid tissue in front of the posterior capsule of the gland than would otherwise have been the case. This, however, must not be an excuse for leaving enough thyroid tissue to cause a persisting degree of hyperthyroidism and to make probable a recurrence of thyroid hyperplasia which was commonly seen in the earlier days of incomplete operations but now seldom seen following a radical operation.

TETANY

Removal of, or severe injury to the parathyroid glands may cause a very grave

complication in the form of tetany. Rabinowitch[5] has shown that following thyroidectomy the blood calcium very commonly decreases temporarily, which would suggest that the trauma incident to the operation inhibited for a time the function of the parathyroid gland, but very seldom to a degree sufficient to cause the manifestations of tetany.

I have in mind a young woman in the third decade of life on whom I did in April, 1926, a bilateral resection of the thyroid gland for exophthalmic goiter. During the operation I demonstrated to the assistants and two physicians who were spectators, tissue which appeared to be the right lower parathyroid body, and during the steps of the operation due care was taken to preserve its blood supply and avoid trauma to its structure. Twenty-four hours after the operation, the patient complained of a sense of extreme weakness and numbness and stiffness of hands; when I saw her twenty minutes later she presented a typical picture of tetany. She was very excited and felt sure she was going to die. Her hands presented the characteristic obstetrical hand appearance. The feet and toes were affected to a lesser degree. Morphine, one-quarter grain, hypodermatically was administered and large doses of calcium lactate given by mouth. In thirty minutes the spasm had diminished considerably and six hours later had entirely disappeared. For a few days calcium salts were administered with a diet high in calcium but no further manifestations of tetany developed.

One month ago, just eight months following the seizure, I had the opportunity of examining this patient. She had entirely recovered from any evidences of exophthalmic goiter and her blood at this time showed 9.8 mg. calcium per 100 c.c. The fact that in this case one of the parathyroid bodies was visualized and avoided at operation followed twenty-four hours later by a typical seizure of tetany which disappeared in six hours not to recur again, goes to show that it is not necessary to remove the parathyroid bodies in order to have symptoms of tetany develop. Should the spasms have persisted, the use of Collip's[6] parathyroid hormone would have been indicated. This case and one other more persistent type are the only manifestations of this disease which I have seen in the last 600 cases of thyroidectomy, for the various surgical forms of goiter met with.

GLYCOSURIA AND DIABETES MELLITUS

The lowered sugar tolerance so commonly described in exophthalmic goiter seems to be found quite commonly too in toxic adenoma and it is sometimes difficult to differentiate between the glycosuria of hyperthyroidism and that of true diabetes mellitus accompanied by hyperthyroidism.

In the presence of hyperthyroidism, a glycosuria or hyperglycemia can be said to be due to diabetes mellitus when the respiratory quotient does not appreciably increase after the usual meal of 100 gms. of glucose under basal conditions and when the arterial blood sugar is higher than the venous blood sugar, except in very severe forms of diabetes when the contrary may be found.

The following case history is interesting from the point of view of non-diabetes glycosuria and hyperglycemia in the surgical care of hyperthyroidism:

Mrs. W., aged fifty-six years, presented herself July, 1926, complaining of a large goiter, loss of 35 pounds in weight, and great loss of strength, shortness of breath on mild exertion, nervousness and irritability. These symptoms had first been noticed one year before and had gradually become more severe, the goiter however having existed some twenty-five years. Examination revealed a rather frail woman with a large adenomatous goiter more marked over the left side. A tremor of fingers, moist skin, heart not appreciably enlarged, regular and rate 104 per minute, blood pressure 170/95, basal metabolism plus 28 per cent. Sugar present in the urine. Diagnosis: toxic adenoma of thyroid gland with lowered sugar tolerance.

After the usual preparatory measures on

July 21, 1926, under gas oxygen and local anesthesia, I resected this large goiter. Forty-eight hours after operation, patient seemed somewhat dull and apathetic and said she felt weak and tired. The following day she was definitely stupid and her breath had the "sweetish" odor of acidosis. Her blood sugar was estimated and proved to be 600 mg. per 100 c.c. of blood. Acetone and diacetic acid were present in the urine. Glucose and insulin treatment was immediately begun by an associate internist and in four days her blood sugar was quite normal and the urine was sugar free. Ten days later, this patient was sent to her home in a neighboring province with instructions as to how she should take care of herself and also with a note to her physician who was to supervise her progress. Five months later, I received a report from the patient to the effect that she was in first class condition, had regained her lost weight, and had been taking a full diet and although her urine had been examined repeatedly there had at no time since her return home been any evidence of the presence of sugar.

Such an increase in blood sugar following operation as was noted in this case would suggest the existence of a true diabetes mellitus, but the entire absence of any evidence of this disease for so many months following removal of the goiter is I think conclusive evidence that it never existed.

In all cases of glycosuria complicating hyperthyroidism I would recommend the careful study of the blood sugar especially during surgical treatment and the early application of insulin therapy to control increasing sugar concentration of the blood.

TECHNIQUE

There are many other complications of thyroid surgery some of which are the direct result of bad technique. Primary hemorrhage can best be prevented by developing a technique which will securely occlude the chief arteries to the gland, the superior and inferior thyroid arteries. A dry wound after the patient has coughed or strained should be secured before closure is proceeded with.

Injury to the parathyroid bodies and the recurrent laryngeal nerves is also best avoided by a technique which carries the line of incision through the thyroid on a plane just anterior to that in which these structures lie. By keeping just in front of the posterior capsule the most radical form of operation required for hyperthyroidism may safely be carried out. The avoidance of such a tragic complication as a severe and persistent form of tetany or a bilateral abductor paralysis of the vocal cords sometimes entailing a tracheotomy is well worth considerable effort in cultivating such a form of technique.

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PREOPERATIVE IODINE THERAPY IN TOXIC GOITER

INDICATIONS AND LIMITATIONS*

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THE purpose of the present paper is to discuss the use of iodine as a measure preliminary to operation in cases of toxic goiter. The indications for and limitations of this drug will be particularly emphasized. It may be well to state at the outset what I conceive to be the object of the iodine therapy, so far as the surgeon is concerned. Iodine is given not with the intention of curing the disease, but for the purpose of bringing about a state in which an operation can be performed with the greatest safety to the patient. The efficacy of preoperative iodine therapy may be a matter of doubt, if not frank scepticism, in the minds of some of our surgeons. To these it may be permissible to suggest that disappointment is more likely to result from an inadequate than from a too vigorous preoperative use of the drug.

No doubt the surgical treatment of patients with toxic goiter may be practiced, with a goodly measure of success, by surgeons of extensive experience and sound clinical judgment, without recourse to iodine. It is questionable, however, whether anyone who has used iodine consistently and thoroughly would be willing to be deprived of the advantages of this therapeutic aid.

In view of our present limited knowledge, it is necessary to base our interpretations of the effects of iodine upon purely empirical methods. The fact that we are unable to define precisely the mechanism that governs its action does not lessen our obligation to employ an agent whose benefits have been abundantly proved by clinical experience. Clinical observations are valuable in proportion to the experience of the observer, the care with which the observations are made and the broadness of vision with which the problem is approached.

In 1869 and again in 1874, Cheadle[1] reported series of cases of exophthalmic goiter and made the following observation: "Be the explanation what it may, the fact remains that the only decided result obtained by treatment in any of this series of cases followed the administration of tincture of iodine, as in the preceding series of 1869." In 1911 Marine and Lenhart[2] published their observations on exophthalmic goiter. These authors noted clinical improvement following the administration of iodine and described the effects of the iodine upon the thyroid gland, namely, the involution of the hypertrophy and hyperplasia to the colloid or resting state. Moreover, they noted a lower postoperative mortality rate in the patients whose thyroids approached the normal gland in regard to histological changes and iodine content. They state: "In our opinion operations should not be undertaken until the thyroid has returned to its colloid or resting state, whether this has occurred spontaneously during the general treatment or has been hastened by the action of minute doses of iodine." In 1923 Plummer and others[3] at the Mayo Clinic made extensive observations on the preoperative use of iodine in cases of exophthalmic goiter. They pointed out

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the advantages of this measure, and deserve credit for establishing the procedure upon a practicable basis.

During the past three years the observations of the foregoing authors have been amply confirmed. At the same time it has been noted by various writers that in a certain percentage of cases clinical improvement following the administration of iodine is negligible, and in some instances the condition has been aggravated by the iodine. It is desirable to know why these exceptions to the rule occur. What is it that determines whether the response will be favorable, negligible or adverse? Although this question cannot be answered with any degree of finality at the present time, there are certain important factors that influence the response. Fortunately these can be evaluated clinically and may well serve as guides in the management of our cases until more reliable criteria are proposed.

To avoid repetition, I may state here as my conviction, that any advantages claimed for or disadvantages attributed to the use of iodine in cases of toxic goiter, apply with equal validity whether the thyroid be adenomatous or non-adenomatous; whether the clinical diagnosis be exophthalmic goiter or so-called toxic adenoma. The reasons for this conclusion have been given in previous publications.[4]

INDICATIONS FOR THE ADMINISTRATION OF IODINE

There is but one indication for the administration of iodine to a patient with toxic goiter, namely, the presence of active hypertrophy and hyperplasia of the thyroid gland. The degree of hypertrophy and hyperplasia depends upon a number of variable factors, among which may be mentioned: the age, size and physical state of the patient; the duration and severity of the disease; the quantity of iodine delivered to the thyroid in assimilable form; the period of time during which the iodine is available; the size, character and iodine content of the thyroid at the onset of the disease.

The importance of a correct estimation of the factors just enumerated cannot be too greatly stressed, since it is these that determine the degree of active hypertrophy and hyperplasia present at a given moment in a given case, and this in turn determines the quantity of iodine that will be tolerated with benefit, or at least without harm.

In the present discussion, assuming that surgical treatment is the method of choice, and assuming further that complications such as cardiac decompensations, auricular fibrillation, acidosis, hyperglycemia and hypoglycemia, active infection, pregnancy, etc., will be treated in accordance with the usual indications in each case, it may be useful to consider cases of thyrotoxicosis in two categories, namely, those that have not and those that have had previous iodine therapy.

Cases that have had no iodine previously. The most striking improvement has occurred in well-developed cases of toxic goiter of short duration, with or without exophthalmos, but with uniform diffuse thyroid enlargement, with well-defined thrill and bruit, the thyroid being soft in consistency. With rest in bed, high caloric diet, and Lugol's solution (or other suitable preparation of iodine) such cases invariably, in my experience, have shown a decided improvement, manifested by a decrease in the nervousness, flushing, sweating, palpitation, tachycardia, and a corresponding decrease in the basal metabolic rate. With the improvement in the clinical condition the thyroid becomes firmer and in time may become quite hard; the thrill disappears, the bruit diminishes in intensity and duration and finally also disappears. The change from the soft vascular thyroid with thrill and bruit to the firmer or hard gland without thrill or bruit is the result of the storage of iodine and colloid material in the organ. I have gained the distinct impression that the greatest advantage occurs when the hypertrophic and hyperplastic thyroid is involuted to the colloid state by comparatively large doses of iodine in a comparatively short

period of time. Moreover, there seems to be an advantage in beginning the iodinization during the first few days of hospitalization rather than in the second or third week after admission.

Cases such as I have just described constitute the most favorable group from the standpoint of the surgeon. With adequate preparation a primary subtotal thyroidectomy is a safe procedure in most instances. Occasionally it may be found necessary to resort to ligations or hemithyroidectomy.

In contrast to the early and moderately advanced, though favorable cases, are those in which the disease has been established for years, and in which periods of remission have been followed by periods of exacerbation. Many of these cases seek relief from the complications of the disease rather than from the disease itself. The general course of the disease as judged by the basal metabolic rate is on a lower level than obtains in the more favorable group. The thyroid may be neither visibly nor palpably enlarged; it is usually hard and frequently cirrhotic; frequently there is no thrill and there may be absence of bruit. In spite of the smallness, hardness and absence of thrill and bruit, the thyroid in such a case may be expected to show hypertrophy and hyperplasia, provided iodine has not been taken within the few months immediately preceding the first observation. The quantity of iodine necessary to effect a maximum clinical improvement in these cases is less than that required in the more favorable group. The indications for its use, nevertheless, are the same, namely, hypertrophy and hyperplasia of the thyroid. The extent of operative intervention in such cases cannot always be formulated in advance; it must be determined by the clinical experience and judgment of the surgeon in each instance.

Cases that have had iodine previously. The patient with thyrotoxicosis who has had iodine, either as a therapeutic agent or as iodized table salt, coming under the observation of the surgeon for the first time, presents a problem quite different from that of the patient who has had no iodine. So far as the preoperative preparation by iodine is concerned the indications are the same, but the favorable and striking improvement noted in previously untreated cases often is not obtained. These are the cases that require the greatest consideration on the part of the surgeon in regard to diagnosis, surgical intervention, and prognosis.

It is not sufficient to know the mere fact that the patient has had iodine before coming under observation. It is advantageous to know the amount of iodine, the period of time during which the drug has been taken, the interval that has elapsed since the last dose, whether the average daily intake was relatively large or relatively small. It is equally important, from a careful consideration of the patient's clinical history, to estimate as nearly as possible the intensity and duration of the disease and the condition of the thyroid gland at the beginning of the iodine treatment. The estimation thus arrived at, when compared with our clinical evaluation of the patient's state on first coming under observation, furnishes an index of the possible benefits to be expected from iodine as a preoperative preparation. In spite of most earnest efforts we are doomed to disappointment in a certain percentage of cases, and unfortunately we cannot tell which cases until we have carried out the clinical experiment of administering iodine. We need not persist in the treatment if improvement does not follow soon.

While the most favorable cases, from the standpoint of surgical intervention, are those that come to the clinic without the previous use of iodine in any form, the fact that iodine has been administered or taken does not necessarily rob the surgeon of his opportunity to avail himself of this valuable aid. With a free interval of one year, six months, and even three months in most cases, previous iodine therapy can be disregarded so far as its resumption as a

preoperative preparation is concerned. I have observed a favorable response with an interval of only three to six weeks in some cases. Irrespective of how much iodine a patient has had it is probably not a safe procedure to discontinue the drug entirely within the period of ten days to two weeks immediately preceding a thyroidectomy.

On admission to the surgical clinic, a correct interpretation of the condition of the thyroid gland is important in cases that have had iodine. Our only means of knowing whether the patient has had iodine, in some cases, is by examination of the thyroid with reference to its size, consistency and vascularity. Patients under treatment may not know what medicine they are taking; the physician may assure us he has not given iodine; but the condition of the thyroid may clearly indicate that iodine in some form has been ingested. There can be no doubt that the long-continued use of iodine can and does materially affect the thyroid gland in the course of a case of toxic goiter. The degree of thyroid enlargement associated with Graves' disease, other things being equal, is distinctly less in patients who have had iodine during the developmental phase of the disease, than in patients who have had no iodine.

The average case of toxic goiter that has had previous iodine therapy usually has not had a sufficient quantity of the drug to nullify its use as a preoperative preparation. Occasionally, however, we do encounter cases that have had iodine in large quantities and for a prolonged period, even to the day of first consultation with the surgeon. These cases, together with those that have had a recent interruption of the iodine therapy, may tax the ingenuity of the surgeon to the limit, since continuation or resumption of iodine may effect very little improvement in the clinical status of the patient and sudden discontinuance of the iodine may be followed by a severe relapse. The condition of such a patient may be desperate; the surgeon may be forced to do ligation or hemithyroidectomy in a case which otherwise would do well following thyroidectomy. It is astonishing what huge quantities of iodine may be given in these cases without effecting complete involution of the thyroid.

LIMITATIONS OF THE USE OF IODINE

It is quite generally agreed, I believe, that iodine is not a cure for toxic goiter in any form, however valuable it may be as a preparation for thyroidectomy. This contitutes its first limitation. While the second limitation is not precisely definable, clinical experience has demonstrated the utter futility of further iodine therapy in the already overiodinized patient. This is a matter over which the surgeon usually has no control; it is to be hoped that he would not deliberately subject his patient to such a disadvantageous regimen. The clinical indications of overiodinization are: increasing consistency of the thyroid, decreasing intensity or disappearance of the thrill and bruit, associated with an increasing basal metabolic rate and persistence or aggravation of the clinical manifestations of the disease.

The third and absolute limitation of iodine as a therapeutic agent in cases of toxic goiter is the presence of a normal or completely involuted (colloid goiter) thyroid. No immediate benefit is to be expected from iodine under such circumstances, irrespective of what the clinical diagnosis may be.

SUMMARY

The most favorable response to iodine therapy occurs in patients who have had no previous treatment. The quantity of iodine necessary to effect the maximum clinical improvement is determined very largely by the size of the thyroid and the degree of active hypertrophy and hyperplasia at the time the iodine therapy is instituted. The best clinical index of the degree of hypertrophy and hyperplasia of the thyroid is the consistency and vascu-

larity of the gland. Patients who have had iodine previously show the greatest variations in their response to its use as a preparation for operation. Excess quantities of iodine over prolonged periods of time deprive the patients of the advantages of this otherwise valuable therapeutic aid in preparing them for the operative ordeal, unless there has been an interval of at least one month without iodine before its resumption as a preoperative preparation. Even though the response, in such cases, may not be so favorable as one might hope for, it appears to be a wise procedure to resume the iodine before performing thyroidectomy. Thrill and bruit are sufficient indication for its resumption. If the patient has had sufficient iodine to completely involute the thyroid, its further use is not likely to be beneficial. However, the drug should not be discontinued, in such cases, immediately preceding thyroidectomy. The presence of adenomas in the thyroid is not, per se, a contraindication to the use of iodine preliminary to thyroidectomy. Even though we do not understand and cannot satisfactorily explain all of the phenomena observed after the administration of iodine, its preoperative use in the surgery of toxic goiter is justifiable, provided we confine ourselves to its beneficial effects and do not transgress its limitations.

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[SURGICAL SUGGESTIONS]

IN A femoral hernia the peritoneum is easily drawn down as far as one wants to assure complete removal of the sac. The surgeon should not, however, draw it down so far that he also pulls down and perhaps cuts the bladder.

WHEN operating upon a strangulated intestinal hernia, unless the involved loop of gut shows, upon release, *active* circulation and *lively* peristalsis, it is risky to return it to the abdominal cavity. It happens not infrequently that a strangulated loop giving fair evidence of viability goes on to gangrene after reduction.

CARDIOSPASM COMPLICATED BY PULMONARY ABSCESS

A CASE REPORT*

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ROCHESTER, MINN.

PULMONARY symptoms are not uncommon in cases of cardiospasm. The pressure made by a dilated esophagus filled with food may cause considerable dyspnea, even to the point of producing attacks simulating those of bronchial asthma. Regurgitation of food and mucus with aspiration is often followed by chronic bronchitis or bronchiectasis.

The following case is one of cardiospasm in which acute pulmonary abscess resulted probably from regurgitation and aspiration of food and mucus. The data in this case are of interest not only because of the unusual complication but because the cardiospasm was cured by dilating the cardia and because the pulmonary abscess resolved following a single bronchoscopic aspiration.

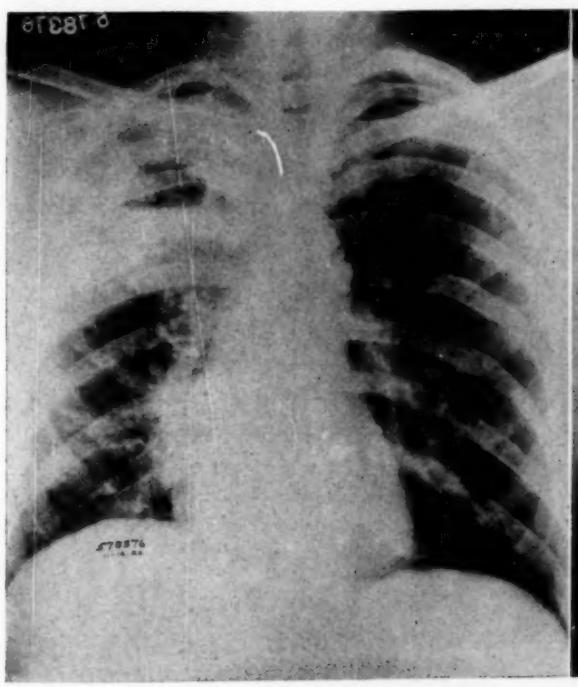


FIG. 1. Large abscess with fluid level in upper lobe of right lung.

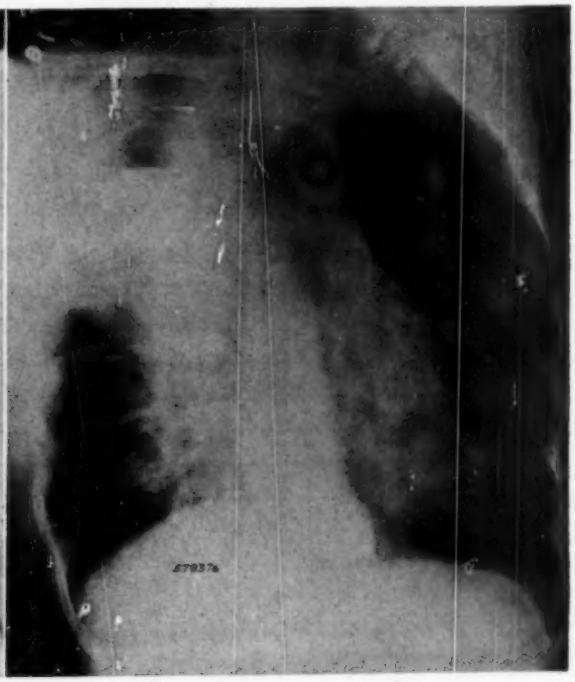


FIG. 2. Cardiospasm with moderate dilatation of the esophagus.

A man, aged forty-two, was examined in the Mayo Clinic November 17, 1926. Ten years previously he had noted obstruction at the cardia to the passage of roast beef, apples and chocolate candy. The dysphagia progressed gradually and there was considerable regurgitation of food and mucus both day and night. There was some epigastric soreness but no pain. About a month before the examination cough and fever developed, and foul, bloody sputum

* Submitted for publication January 11, 1927.

was expectorated. There had been one definite chill. There had been a loss of weight of 30 pounds in one year, and of 12 pounds during the preceding month.

The patient was thin and appeared to be suffering from toxemia. The hemoglobin was 60 per cent and the leucocytes numbered 12,000. The temperature was normal. There

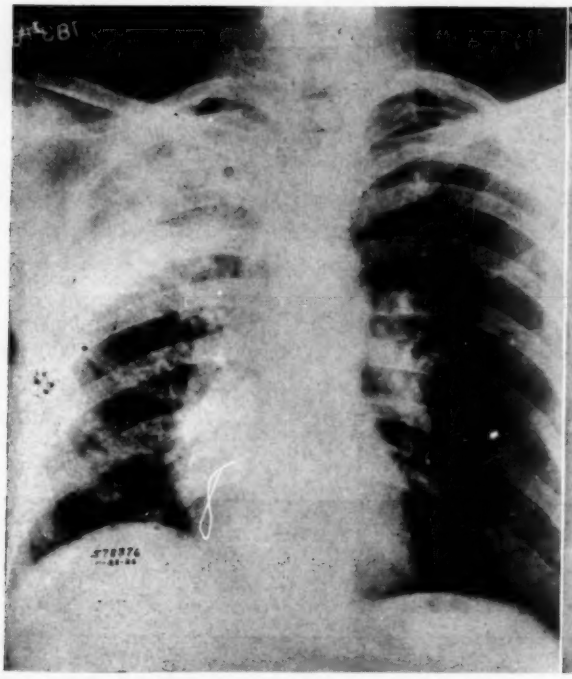


Fig. 3. Marked reduction in the size of the abscess cavity.

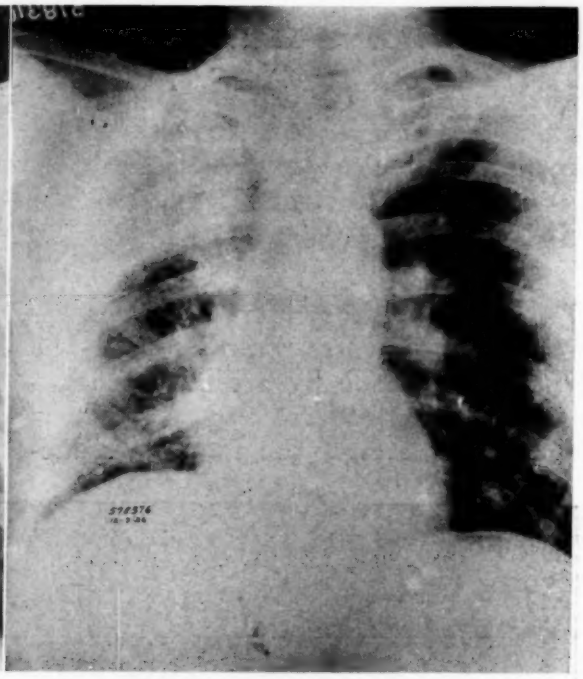


Fig. 4. Further reduction in the size of the abscess.

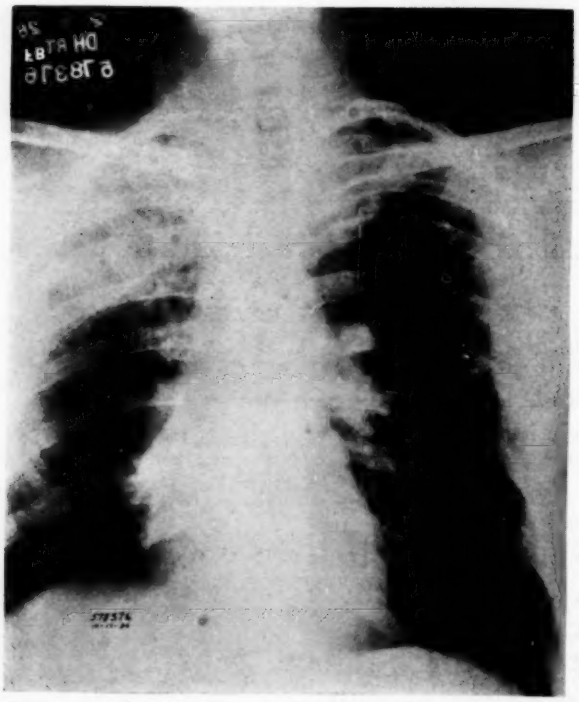


Fig. 5. Roentgenogram of chest one month after aspiration of abscess. Abscess has disappeared and only small amount of pulmonary fibrosis and pleural thickening remained.

was considerable cough with the expectoration of thick purulent sputum. Roentgenograms of the chest revealed a pulmonary abscess with a large cavity in the upper lobe of the right lung (Fig. 1). Roentgen-ray examination of the esophagus showed cardiospasm with diffuse dilatation of the organ (Fig. 2).

Because of the patient's poor general condition it was deemed advisable to pass sounds through the cardia before the hydrostatic dilator was used, and accordingly a 55 French olive was passed into the stomach. Marked relief from dysphagia and gain in weight and strength followed. Five days later bronchoscopy was performed under local anesthesia and a small amount of pus was aspirated from an abscess in the upper lobe of the right lung. The opening into the bronchus of the right upper lobe was enlarged as much as possible. Improvement was progressive (Figs. 3 and 4), but because of slight dysphagia the cardia was dilated with the hydrostatic dilator at the end of two weeks. The patient then swallowed without difficulty. When he was dismissed, December 18, the roentgen-ray examination of the esophagus revealed slight lagging of the barium meal at the cardia and the pulmonary abscess had disappeared almost completely (Fig. 5). There was practically no cough and no expectoration. The hemoglobin was 70 per cent and the leucocytes numbered 9100. The patient had gained 15.5 pounds.

[SURGICAL SUGGESTIONS]

IN THE treatment of paralytic ileus pituitrin is often life-saving. Give it *intravenously*, and repeat it as often as necessary so long as it continues to be effectual. In rebellious cases the pituitrin ceases to be effectual after a few days or fatal toxemia develops in spite of the response to each dose. Eserine is also a valuable excitant of peristalsis. An injection of cholin may work when eserine and pituitrin fail.

FOR postoperative tympanites an enema of equal parts of milk and molasses is often promptly effectual. If this or similar clyster fails, do not hesitate to use pituitrin and, to be sure of prompt and maximum effect, inject it intravenously.

IN some cases of persistent ileus the pylorus becomes so dilated and the duodenum so distended that stomach and duodenum appear as one huge organ. It is in such cases, probably, that jejunostomy offers its best chance of giving relief.

AN UNUSUAL ABDOMINAL INJURY

A CASE REPORT*

HARRY BELLEVILLE EISBERG, M.D., F.A.C.S.

NEW YORK

ABDOMINAL injuries, due to crushing forces, produce an infinite variety of lesions. One of the most unusual forms of this type of injury is illustrated by the following case:

P. R., aged eight, colored, was admitted to the accident ward of Harlem Hospital, January 19, 1925. The history disclosed that the child was "hitching" on an automobile and fell on his abdomen. It could not be ascertained whether or not he was actually run over.

FIG. 1. Diagrammatical representation of the injury described at operation.

On admission the child was complaining of pain in the abdomen. He was conscious and in moderate shock. The pulse was 120, regular, of small volume and poor tension.

There was no evidence of external injury. There was no distention or rigidity but a slight generalized tenderness was elicited over the abdomen. A fluid wave was present, and on percussion there was flatness in the flanks, with shifting dullness.

Excruciating tenderness was brought forth on slight compression of the pelvic bones. The perineum was intact, but there was a protrusion of about 20 cm. of dark-colored small intestine from the anus. The anus itself was not injured.

FIG. 2. Post-mortem roentgenogram showing crushing fracture of the fifth lumbar vertebra and fracture through the left acetabulum.

The temperature was 97° F., pulse 120, respirations 24, blood: red blood cells 4,500,000; hemoglobin 70 per cent; white blood cells 40,000, polymorphonuclears 94 per cent, lymphocytes 6 per cent.

* From the surgical service of Harlem Hospital, New York City.

The preoperative diagnosis was made of (1) rupture of the rectum with extrusion of the small intestine through the anus, (2) fractured pelvis.

On opening the abdomen, a loop of ileum 60 cm. long was found torn from its mesentery, which passed through a rent in the mesosigmoid from right to left and downwards through a tear in the posterior parietal peritoneum, approximately over the sacroiliac synchondrosis. Further examination revealed the same loop passing downward behind the rectum, which was stripped from the hollow of the sacrum and had a laceration 5 cm. in length, 2 cm. above the anal margin through which this same loop passed and finally protruded from the anus (Fig. 1). The torn mesentery was bleeding. The mesosigmoid was torn in an avascular area. There was considerable bleeding from the tear in the posterior parietal peritoneum. Spicules of bone were felt in this region. The iliac vessels and part of the lumbosacral cord were exposed.

The free blood was sponged out of the peritoneal cavity. The mesenteric hemorrhage was controlled by suture. There was a generalized bleeding from the rent in the posterior parietal peritoneum over the sacroiliac synchondrosis, but no active spurting vessels. This hemorrhage was controlled by tight packing. The gut was clamped and cut at the point of separation from the mesentery. Ends of the torn segment were closed with a purse-string suture, and the segment was removed by pulling the protruding gut from the anus. A lateral anastomosis was performed and the rent in the mesosigmoid sutured. The rent in the rectum was sutured. The posterior parietal peritoneum was sutured over the packing in the hollow of the sacrum. The end of the packing was pulled to the lower end of the abdominal wound. Two cigarette drains, one pelvic and the other in situ, were employed. Routine closure. A rubber tube was inserted into rectum, reaching above the perforation.

Patient expired shortly after operation while an infusion of saline was being administered.

A post-mortem roentgen-ray examination showed a fracture through the left acetabulum and a crushing fracture of the fifth lumbar vertebra (Fig. 2). Autopsy verified these findings and disclosed in addition a partial dislocation of the sacroiliac synchondrosis. There was no intraperitoneal hemorrhage or other visceral injury except the repaired intestine described at operation. The lateral anastomosis was patent and no leakage at the suture line was present.

COMMENT

The probable mechanism of the injury was as follows: the tearing of the gut from its mesentery, the rent in the mesosigmoid and tear in the rectum occurred simultaneously. Later the detached bowel sought the path of least resistance. The anal sphincter being dilated, the result of shock, allowed the loop of bowel to escape externally.

[SURGICAL SUGGESTIONS]

A LOOP of bowel strangulated or long incarcerated in a hernia may retain its viability after the operation, yet maintain a persistent paresis causing an ileus at that level.

TRANSACTIONS OF
THE SECTION OF SURGERY
NEW YORK ACADEMY OF MEDICINE

Meeting of January 7, 1927

THE CHAIRMAN, DR. FREDERIC W. BANCROFT, PRESIDING

METABOLISM IN BURNS*

JOHN J. MOORHEAD, M.D.

(Condensed)

THE local and systemic manifestations of burns partake of the metabolic reactions common to infections in general, particularly to wound infections. It is a common observation that burns of like origin, of like local effect, are widely diverse in their systemic effects upon persons alike as to sex, age, race, occupation and station in life. For example, shock from a burn may appear early, or it may be delayed for from three to seven days, or to as late as the fourteenth day. Children, in particular, are prone to manifest these early, intermediate or late shock phenomena, and the causation has usually been ascribed to psychic trauma, to infection or to the absorption of burnt tissue. These manifestations are by no means limited to extensive burns, deep or otherwise. Burns by electricity are supposed to be less painful, to heal more rapidly, and to offer a most favorable prognosis. My observations do not confirm this. I have rarely seen an electrical burn in the absolute sense, most of them being in reality heat or flame burns.

In some crushing wounds, there is a retarded or late shock definitely assignable to absorption of devitalized tissue elements. This is, in effect, a protein reaction, anaphylactic shock.

We have tried in our series of cases to show the exact nature of this reaction in terms of blood chemistry in the hope that we could thereby suitably alter the circulating blood, thus preventing or minimizing this form of shock. We have also attempted to determine the bases for speedy repair, aiming to provide the organism with means to combat infection in the belief that wound sterilization is best attained through the medium of the circulating blood rather than through the agency of antiseptics, however highly these are vaunted. Antiseptics act only by virtue of mechanical cleansing, by virtue of dissolving slough, by staining and thus fixing the organisms, and by a process of local germ killing that must be limited if the tissues themselves are not also to be killed.

The laboratory will eventually solve this infected wound problem for us by showing us how to alter the circulating fluids in such a manner that organisms of a particular type cannot grow in a given habitat. In horticulture this soil reaction is a matter of relatively easy determination, so that forestry, for example, is governed by the chemistry of the soil as well as by climate, altitude and proximity of rocks or flowing streams. The organisms that defoliate a forest have in many instances been checked, not by spraying the trees, but by altering the nitrogenous content of the soil. It is an old trick in farming to rotate crops.

My belief is that something of this same sort is taking place in our present conception of infected wounds, burns and others. Recently we deliberately planted pyocyaneus in a bed of streptococcus and the green weed grew abundantly and smothered the coccus; and while the patient recovered with a stiff elbow, the

*With report of laboratory studies by John A. Kilian, M.D. (By invitation.)

arm was saved. We did the same thing in an osteomyelitis with a long-standing crop of staphylococci. Here again the green thrived and changed the entire external appearance of the leg.

We have all seen in sepsis the occasional almost miraculous effect of injections of milk, or typhoid or diphtheria serum, and we regard their effects as a form of protein reaction.

Our aim should be so to alter the circulating fluids that these will be reparative as well as antiseptic. It is therefore interesting to know what blood chemistry shows in burns, and with that in view my collaborator, Dr. Kilian, will report the results of his study of a small number of cases.

A similar line of investigation has been carried out in a group of fractures to determine whether or not the calcium and phosphorous content of the blood offered prognostic criteria. Thus far we have not been able to show any substantial changes, and we do not believe that calcium and phosphorous alterations are anything more than chance findings or normal variants in bone healing. We are convinced that non-union in fractures is not dependent upon demonstrable deficiency either in calcium or phosphorous. The obvious corollary is that these elements play no essential part in wound healing, and if this be true, then the CO_2 content may be the greater factor. Dr. Thomas Buchanan, in charge of the anesthesia department at the Post-Graduate Hospital, has shown that he can alter the clotting time of the blood during an operation by changing the amount of CO_2 in the anesthetic. He believes that the amount of oozing is also controllable through the inhalant, and in this respect at least we all can record the clinical observation that certain anesthetics apparently produce more oozing than others.

Up to this time my own method of managing burns has been to regard them as infected wounds passing through three phases of evolution:

The first phase is that of local inflammation, virtually a dermatitis characterized by redness, pain and swelling. Here the plan is to apply a wet dressing of sodium bicarbonate (5 to 10 per cent), keeping the dressings moist by a fenestrated tube arranged to sprinkle the entire area. We do not disturb this for the two to four day period of this phase, pain being controlled by morphine, the shock being suitably combatted by rectal drip or otherwise.

The second phase is that of exudation, and this we seek to control by exposure of the entire surface to the open air, to sunlight or to the rays from 50 watt electric bulbs. We protect the discharging surface by a cradle or wire mesh. At night, or if crusts form, we cover the area with a gauze dressing soaked in equal parts of sterile olive oil and camphorated oil. We know that this exposure method best provides unimpeded drainage, effectively prevents absorption and thus lessens fever and other systemic manifestations.

The third phase, that of cicatrization, also responds to this same exposure method, and in addition we occasionally add a wound fertilizer in the form of scarlet red ointment, 1 dram, to sterile olive oil, 1 ounce.

At all times we seek zealously to prevent contracture by keeping in advance of it, and thus posture and planned gymnastics are as much a part of therapy as the dressings or external applications. This form of prophylactic physical therapy is just as applicable in burns as are early massage and mobilization in a joint fracture. For example, in wounds of the face and scalp we insist that the patient grimace frequently, blow out the cheeks and chew gum in an attempt to prevent deformation so common in this area.

We reserve débridement for that group, as in other wounds, in which there is localized destruction. If used indiscriminately it may be a source of real danger, or it becomes more mutilative than curative. The greatest sphere of usefulness for

débridement is that form of burn associated with localized wet or dry gangrene manifested by demarcated sloughing, or parchment-like attempted repair. There is also a small group of burns in which early débridement and immediate plastic repair may be attempted to prevent inevitable contractures leading to later plastics.

I have had no personal experience with chemical débridement, as by tannic acid, carbolic acid or zinc. Of these, the tannic acid procedure seems to have the greatest merit.

I know of no method to prevent keloidal formation, but my observation is that it is less prevalent since the adoption of the exposure method. It is my practice not to interfere surgically early in keloids because many of them spontaneously recede and others are softened by roentgen therapy.

For burns of minor degree there is no real objection to occlusive dressings of the paraffin type; but obviously a retentive covering has no more place in a discharging burn than it has in a discharging wound from any other source.

Case I. *Extensive Burn with Tetanus.* Two weeks before admission to hospital on October 19, 1923, this boy, aged eight years, was playing at a fire of leaves in a vacant lot, when his trousers caught fire. To extinguish the flames he was wrapped in a horse blanket which probably conveyed the tetanus infection. He sustained second and third degree burns of both legs, from the knees to the tops of his shoes, which were treated with wet dressings of bicarbonate of soda, followed by boric ointment. On October 18, twelve days after the injury, the wounds were clean but the boy's jaw was taut and he was unable to open his mouth. There was also a leg muscle spasm for three days before admission. The jaw symptoms continued.

Immediately upon admission tetanus antitoxin was administered. Soda bicarbonate dressings were applied to both legs. Later olive oil dressings were applied. Also, in the operating room paraffin dressings were applied under general anesthesia. No grafting was done, yet the result is excellent. Between October 19 and November 4, 91,000 units of tetanus antitoxin were administered: 53,000 intravenously, 13,000 intraspinally, 25,000 intramuscularly, an average daily dose of 5353 units.

Case II. *Burns by Electricity.* Male, aged forty-seven years, an electric switch-board operator. On September 26, 1919, he was walking in a space 3 feet wide, just enough to allow for passage, containing three electric bus feeders, 11,000 volts each. Next to the bus feeders there were protecting iron bars running from the ceiling to the floor. The patient was carrying a rag in his hand and as he was passing these electric buses his foot slipped against the iron upright and the arm that carried the rag went up in the air and came in contact with the electric bus feeders. The patient suddenly became unconscious. He was immediately removed to the hospital where he remained unconscious for seven hours.

He showed third degree burns of the occipital scalp, the right arm and hand and the right heel. The burn of the head showed a denuded area 4 inches in diameter. The skull was exposed. The right hand showed a burn down to the metacarpophalangeal joints. The burn of the right heel exposed the os calcis.

After the patient had been in the hospital twelve weeks an operation was performed to remove the necrosed outer table of the occipital bone. A second operation was performed to cover the denuded area by a skin flap from the surrounding tissue. At a third operation a skin graft from the right thigh was applied. Ultimately this operation was successful.

After discharge from the hospital the patient was treated in our Out-Patient Department and he made a most remarkable and uneventful recovery. He has been working since January 1, 1920. There are no symptoms referable to the burns. He is not in any way incapacitated, he is not disfigured except the scar on his head which is not visible except when closely observed.

Case III. *Burns by Electricity.* Male, aged forty-six years. At the time of his accident, July 19, 1920, the patient was cleaning the walls near some oil switches in a sub-station power house. These power switches were carrying 11,000 volts of electricity. He dropped some water on the oil switches, thus making a short circuit, and a sudden flash of flame enveloped him. He was immediately removed to the

Post-Graduate Hospital where it was found that he had a severe burn of both eyes and face and third degree burns of the right arm and body, chest and right leg. He was in the hospital from July 10 to October 13, 1920. After his discharge from the hospital he was treated in our Out-Patient Department. He made a very unusual recovery. There is no remaining eye disturbance or facial disfigurement. The scars have nearly all cleared up.

Discussion

Dr. Seth M. Milliken: I much enjoyed Dr. Moorhead's paper because I thoroughly agree with him, except that I consider a burn by electricity the same as any heat burn on the surface of the body and do not place it under a separate classification.

Dr. William T. Doran: I hope the work of Dr. Moorhead and of Dr. Kilian will soon result in a decrease in the ultimate effect in some of these cases. At the present time in most of the hospitals we are doing the best we can, but all not having the best equipment, the results from the methods of treatment used, such as tannic acid, are not always what we would like. I hope there will be brought out something of permanent value and within the use of all.

Dr. Clay Ray Murray: I was interested in what Dr. Moorhead said about the blood calcium and phosphorus changes and their relation to metabolism in burns. In checking up Tisdale's work with Eddy of Columbia we held the idea that this metabolic change was a general manifestation of the healing in process, not specific for bone healing, and some 80 cases where the laboratory reported this change there were several cases of extensive burns in which calcium and phosphorus in the blood were increased. This we regarded as a manifestation of healing processes resulting after the burn itself, and therefore having no specific relation to the burn.

Dr. Ralph Colp: I think we should be grateful to Dr. Kilian for his excellent work, but if we reflect on these metabolic changes we must be struck with their similarity to those we see in cases of acute intestinal obstruction, gall-bladder disease complicated by cholemia, and kidney disease terminating in uremia. Diminution in the blood chlorides is present in intestinal obstruction and with this usually occurs an increase in the non-protein nitrogen, urea in the uric acid and often the creatinin. Cases of severe burns have been associated with the duodenal lesions. Cases of intestinal obstruction are often associated with duodenal lesions, and occasionally in both these conditions a fatal anuria occurs. Therefore, I do not believe that these metabolic changes observed in Dr. Moorhead's cases are applicable only to cases of burns, but are rather a page in the general metabolism occurring in the conditions described above.

Dr. Frederic W. Bancroft: The whole problem of burns is very interesting. The most pathetic cases to me are those that live on to the third week and then die. They may be given saline infusions and transfusions, but despite all treatment they die, often fairly suddenly. There is something we must learn about the cause of this if we are to save this type of case, and I believe Dr. Moorhead and Dr. Kilian are working in the right direction. One does not feel so bad about patients who die of the immediate shock but we should study this late type carefully, for we are as yet ignorant of the cause of death and we may learn some method of improving the condition.

Dr. Moorhead (closing): Replying to Dr. Colp regarding gastrointestinal symptoms, I have a distinct impression that among the cases of burns I am seeing now there have rarely been such manifestations. Gastroduodenitis was formerly considered to coexist often with burns.

Dr. Kilian (closing): Dr. Murray mentioned changes in calcium of the blood in wound healing. We followed some of those cases and found that in some of them in an early period immediately after the burn there was a drop in calcium and a rise in phosphorus but later the calcium rose to a very high level. That was probably associated with tissue healing. I do not believe we can explain the changes in the chloride in the blood and urine on the basis of intestinal obstruction or changes in the gastrointestinal tract. Others have done valuable work on the influence of the gastrointestinal tract and show that intestinal obstruction associated with vomiting leads to lowered blood chloride with diminished output in the urine. But we cannot explain the changes in burns by a loss of chloride in vomiting or retention in gastrointestinal tract. Some other explanation will have to be offered for this drop in the chloride. It is similar to the change seen in chloride metabolism in pneumonia; that cannot be explained by associated changes in gastrointestinal dysfunction. There have been

numerous attempts made to explain these changes but all of them have been unsuccessful. I do not believe we will ever be able to explain the origin of the toxemia referred to by Dr. Bancroft without extensive animal experimentation and that presents difficulties with the Society for the Prevention of Cruelty to Animals.

FRACTURES OF THE TRANSVERSE PROCESSES OF THE LUMBAR VERTEBRAE

ROBERT H. KENNEDY, M.D.

(*Abstract*)

There is apparently considerable difference of opinion in regard to the frequency, importance and treatment of fractures of the transverse processes of the lumbar vertebrae. From the scarcity of references to this injury one would think the lesion either rare or of little moment. Some even suggest that it is non-existent, the roentgen-ray appearance being due to bony abnormality. A knowledge of the amount of disability caused is important, for one thing, in estimating insurance loss, as many of these are compensation cases. Some state that prolonged immobilization or more radical procedure is necessary, apparently feeling that they are dealing with an injury followed by considerable disability. This paper reviews the literature and our experience in 10 cases at the Surgical Clinic of the Beekman Street Hospital.

Among injuries to the back, fractures of the transverse processes of the lumbar vertebrae are not rare, although it is to be emphasized that bony anomalies in this region are frequent and may tend to confuse the diagnosis. The most common cause of fracture of the transverse processes is direct violence. The symptoms and physical signs are those of a severe sprain or contusion of the back. Such fractures are usually multiple. When uncomplicated by body fracture, all the fractures are usually on the same side.

The disability caused by the injury is due solely to the associated contusion or sprain of the back, and the presence of the fracture is negligible as far as prolongation of disability is concerned. Owing to the frequency of traumatic neurosis, it is preferable that knowledge of an existing fracture be kept from the patient. Bony union of the fractured transverse processes is definite in some of these cases. More careful examination of backs should be made before employing men over forty at hard labor.

The treatment required is rest in bed, heat and massage. Prolonged immobilization is no more necessary than in any contusion or sprain of the back. In this series patients were able to walk after an average period of sixteen days. Disability over six months is out of the ordinary. The majority of patients should be at work within two months with practically no complaints referable to the injury.

Case 1. J. C., male, aged forty-three years, laborer, was admitted to Beekman Street Hospital March 12, 1926, having fallen in an elevator shaft, striking head and back. He had a lacerated wound of the right frontal region and rigidity and tenderness in the lumbar region. Roentgenograms showed fracture of the right transverse process of the third lumbar vertebra. He was kept in bed three weeks, receiving physical therapy. His back was not strapped. He returned to his usual work in eight weeks. After eight months examination showed the function of his spine normal in all movements. He had no complaints referable to his back. Roentgenograms at this time showed apparently bony union. This case is reported to illustrate early return to work and bony union of such a fracture.

Case 11 (*Demonstrated*). B. R., male, aged twenty-four years, laborer, was admitted to Beekman Street Hospital May 18, 1926, a fire reel having run over his back. He claimed that he could not stand and had severe pain on any movement of the back for several days. There was definite hematoma, with rigidity of the muscles in the lumbar region. Roentgenograms showed fracture of the right transverse processes of the first, second and fourth lumbars. He was strapped with adhesive plaster for the first eight days. He sat up in

bed after one week. He commenced to walk in twelve days, but his back was painful on bending. After six weeks, movements of the back in all directions seemed to be complete without discomfort and he had no complaints. Settlement of his compensation was made two months after injury and he returned to light work immediately. I saw him again in October, 1926, five months after his injury. He seemed perfectly well and was advised to do any work he saw fit. This patient is presented to illustrate early return to work and the lack of return of symptoms after a number of months.

Case III (*Demonstrated*). E. K., female, aged eighteen years, stenographer, was admitted to Beekman Street Hospital November 9, 1926, having been struck and thrown down by a motor truck. The mechanism of the injury could not be learned. She complained of severe pain in the lower back. There were tenderness and rigidity of the lumbar muscles. Roentgenograms showed fracture of the right transverse processes of the first, second, third and fourth lumbars with considerable lateral displacement. She remained in bed three and one-half weeks, and received physical therapy, but no strapping. Pain on movement continued for about ten days. She was discharged from hospital December 9, 1926, one month after injury. At this time her examination was negative, except for slight pain on full lateral flexion toward the left side. This patient is presented to show the early result in such an injury.

Discussion

Dr. Clay Ray Murray: I was very much interested in what Dr. Kennedy had to say, and think he has the right idea of the treatment of these cases. I have had opportunity to see a large number of cases of fracture of the transverse processes of the lumbar vertebrae. On what I believed to be the advice of Goldthwait of Boston, I have operated on a number of them, excising the separated fragment. Being able thus to demonstrate the pathology I think that anyone discussing the probable cause of the disability would agree with Dr. Kennedy that the bone lesion is secondary. The nearest description one can use for the condition of the soft parts is "beef-tea"; there is no muscle tissue, it is merely a mass of bloody pulp. In the presence of so severe a muscle lesion, with the scar tissue result, the bone lesion is dwarfed. In addition, in one case, the effect of telling the patient what he had bore out what Dr. Kennedy said. The patient had been operated on and had recovered sufficiently to be able to stand up and walk eight days afterward. At the end of two weeks he could bend over to touch the ground without pain. He was eventually sent back to work and put under the care of one of the compensation doctors who told him he must be very careful as he had a broken back. From then on he was unable to work, has been careful not to endanger his back ever since, and at the end of three months, returning to the follow-up clinic, he was carrying two canes, and had quite a restriction of back movements, but no pain. He had not exercised his back since leaving the hospital. He was "being careful of his broken back."

Dr. James N. Worcester: I think Dr. Kennedy's paper is of great value. Up to three years ago the important thing in fracture of the transverse processes was to keep the patient in prolonged immobilization, with plaster. All these patients knew they had fractured backs and the results were not good. I agree with Dr. Kennedy that it is better not to let them know for since we have followed that system the results obtained have been revolutionary. The psychology of injury to the back is one of the oldest and most difficult problems we have to solve in industrial surgery.

Dr. John J. Moorhead: In these cases the symptoms are sometimes out of all proportion to the objective signs and roentgen findings; in a number of cases the physical signs are slight and the roentgen-ray signs many and vice versa. Dr. Kennedy mentions these facts in some cases. I think a great deal of care should be taken in making a diagnosis of fracture of the transverse processes of the lumbar vertebrae, and one should not pass judgment on a roentgenogram unless verified by someone very expert in reading roentgen-ray pictures. The physical signs should also check up very accurately with the roentgen-ray zones of injury. I am always on my guard when an individual is able to localize a small spot of pain. I pay particular attention to localized tenderness on motion. I consider that this should be observed with extreme care in this and other back injuries inasmuch as painful back arises from many sources.

Dr. Seth M. Milliken: I should like to mention a case in which the patient received

a transverse process fracture by direct violence. He was struck on the back by a rock in an excavation and had a very large hematoma and a very stiff back. He was in bed for a few days and was then encouraged to get up and about. We did not think there was anything the matter with his spine because he had suffered direct violence and we had supposed this fracture was caused by muscular contraction. The roentgen ray, however, showed the defect. The patient had not been informed because we did not believe he had a fracture, and afterward we did not tell him because he was doing so well. At the end of the fourth week he had recovered the entire motion of the back and although the back was still stiff and there was a fossa in the right lumbar region, normal motion could be carried out, although slowly. He made rapid progress under physical therapy so that in seven weeks after the injury he went home. As to the cause of the fracture it is hard to know how this process can be fractured by direct violence and I would like to have Dr. Kennedy explain that to me. Dr. Kennedy remarked that local injury to the muscle caused the symptoms and I agree. The insurance companies' attitude towards fracture of the transverse processes needs correction. "Broken back" is a term they understand. As to the method of treatment, I do not understand the rationale of rest in bed, plaster cast or strapping. Use of the muscle restores circulation and our cases have had no treatment except vocal encouragement. Roentgenograms are very important and should be read by one of experience. In some of the cases I have seen the fracture was obvious; in some it was difficult to diagnose. The first lumbar transverse process is hard to break because it is protected by the first rib. Some of Dr. Kennedy's cases of first lumbar process fracture do not appear to me to be such.

Dr. Edgar D. Oppenheimer: I was surprised to find so many of these cases existed; I have had seven in the past year in a small hospital. The injury must be more common than supposed. I do not think the fracture itself is a serious lesion but there is always considerable attendant back injury. My cases had so much pain that they were unable to do their work properly. To try to encourage them to do work they are not able to do is not our duty. As regards the treatment, I take a different view from that of most of the speakers this evening. I believe that when we get these patients early we should immobilize them. We should give them what support we can with a jacket or brace to get them gradually back to the point where they are able to do light work at first. If we do that we will avoid seeing them get worse after six months, especially mentally.

Dr. Mather Cleveland: The persistence of the pain, in one case presented by Dr. Kennedy, does not seem to me to be necessarily due to fracture of the transverse processes. There are fractures that involve the lamina that cannot be seen by roentgenogram which cause a great deal of pain; and they are sometimes found on exploratory operation. Perhaps this case with fracture of the transverse processes with pain over a long period of time may also have had a lamina fracture. I think Dr. Kennedy's point that industrial organizations would do well to get roentgenograms of the backs of employees is very well taken. There are many people who have potentially weak backs with abnormalities at the lumbosacral junction in particular who, owing to the difficulties of their work and perhaps strain, will develop definite backache, and if one could establish the fact of a potentially weak back it would be of great value in determining the extent or validity of a claim upon the employer.

Dr. Leon T. LeWald: At the last meeting of the American Roentgen Ray Society in a paper by Dr. W. B. Bowman of Los Angeles, it was said that a large trucking corporation has established the rule of having a roentgenogram of the spine made of employees to determine the presence of anomalies of development or deformities from previous injury or disease. I feel that all employers will do that eventually. Dr. Moorhead made an interesting statement relating to tenderness in one spot over a supposed fracture. It is my custom to put a lead marker over such a suspected area and see if it coincides with the fracture line in the roentgenogram.

Dr. Frederic W. Bancroft: I would like to know exactly what occurs in this injury. The transverse processes are so deeply situated that it is difficult to attribute the fracture to direct injury. An indirect injury of such an extent that the muscle will tear out of place three or four lateral processes must produce very marked trauma of the muscles themselves. It will be interesting to know what the results in these cases are one or two years after injury.

Dr. Kennedy (closing): As to the treat-

ment, it seems to me that prolonged immobilization of a bruised back is inadvisable on account of the effect on the muscles. The end result would be worse than if one tried to restore function early. In a sprained ankle one must consider the repair of torn ligaments, while in these back cases the main injury is not to ligament, so that this analogy does not hold.

As to the likelihood of recurrence of symptoms later, referred to by several of the speakers, the longest follow-up has been ten months after injury and there have been two others after eight months. These patients are back at their regular employment, doing routine work, and none has any different complaint after eight and ten months than after three and six months. Two of the 10 cases were complicated by fracture-dislocation. Two could not be traced. Six were working in six months and one of them still complained of pain. He had three transverse processes fractured, but all seemed to have united. He has complained of pain, however, ever since he discovered he had a fracture.

As far as the character of the producing violence is concerned, there must be muscular strain in all of these cases, unless the injury is such that all tissues between the skin and the transverse processes are injured. The meaning of direct violence that I intended to convey, was force applied at the level of the injury. In reference to confinement in bed, I feel that these patients deserve rest in bed until there is no pain, or very little, on motion, because we are dealing with damaged muscle. In reply to Dr. Oppenheimer, I do not feel that we were forcing these patients to return to work. They were able to do so and thus far have been none the worse for it.

FECAL FISTULA: AN AID TO CLOSURE

DAVID H. ORGEL, M.D.

In his article on "Pneumatic Rupture of the Bowel,"[1] George L. Hays refers to the use of a Barnes bag to stop drainage from the cecum after cecostomy.

This method was resorted to by me in the treatment of a fecal fistula where the drainage from the ileum was copious, absorption of the upper bowel contents was lacking and the general condition of the patient was deteriorating from lack of nourishment, although he was taking plenty. The discharge of the contents of the small intestines produced an unhealthy condition of the skin and tissues for some distance adjacent to the wound and prevented granulation and healing in spite of all protective measures.

I had a Barnes bag made with a constricted central portion, giving the bag a sort of hour-glass or fiddle shape. On introducing this modified Barnes bag into the small intestine up to its narrow part, distending it gently with air and clamping the tube, we were able to diminish the discharge and, with constant care, the parts began to look normal and the patient regained his health and strength so that a secondary operation for the closure of the fistula could be and was successfully undertaken at the City Hospital.

This aid should be used in cases of large fistulae only.

[1]Hays, G. L. Pneumatic rupture of the bowel. *Surg., Gynec. & Obst.*, 1926, xliii, 491.

PRESENTATION OF CASES

ABSCESS OF THE LIVER

JOSEPH E. J. KING, M.D.

J. L., Italian laborer, aged fifty-five years.

History: Detailed history could not be obtained on account of patient speaking but little English.

He had pain in the right side of abdomen, upper portion, first noticed two weeks before. During the first four days the pain was very severe. He vomited frequently (no blood). Vomiting had no relation to meals or taking of food. He was in bed during the first five or six days of his illness on account of pain and vomiting. During the three or four days before examination he had complained of pain in the upper right quadrant, but this pain had not been severe. He was nauseated from time to time but vomiting was not marked. He had lost considerable weight during the last two weeks, although he had been gradually losing weight for a year or more. His chief complaints, when he presented himself for examination on October 5, 1926, were pain in the upper right abdomen and nausea with occasional vomiting.

Physical Examination: General appearance: Rather emaciated; did not appear to be acutely

ill; walked about with his hand over the upper right abdomen, somewhat stooped forward. He was not jaundiced. General physical examination was negative with exception of abdomen and pulse rate. Pulse: 44 to about 48, full, strong and regular. Blood pressure not taken.

Abdomen: General bulging or fullness of the right upper quadrant which did not appear to shift with respiration. The skin was not reddened or indurated. Tenderness over the region of the gall bladder and slight rigidity of the muscles. No circumscribed tumor mass could be made out but a definite fullness in this region could be determined. Pressure at this site produced pain which did not radiate in any direction. Liver dullness increased downward 1½ inches below the costal margin. Urine was negative, no bile present. Blood chemistry was negative.

Provisional diagnosis: 1. Abscess of the liver; 2. Gall-bladder disease with cystic duct obstruction; 3. Echinococcic cyst of liver.

Roentgen Examination: The patient was sent to Lexington Hospital. Roentgenograms showed a ring-like shadow in the area of the liver with its inner border reaching almost to the right border of the vertebral column. This shadow measured about 2½ inches in diameter. Its upper margin was 2 inches below the shadow cast by the dome of the diaphragm. The level of the diaphragm was not exaggerated on the right.

With barium meal, the duodenal cap was cupped, resembling an acorn cup, the duodenum measuring 1¾ inches in diameter, and ¾ inch in depth. These plates showed definite evidence of a mass from without pressing on the duodenum.

Diagnosis (from radiographic films): Enlarged gall bladder or a mass in the liver: abscess, cyst or tumor.

Operation: October 7, 1926.

There was a bulging, fluctuating mass on the under surface of the liver which corresponded in position to the depression in the duodenal cap shown on the roentgen-ray plates. This was considered to be an abscess rather than an echinococcic cyst on account of its degree of fluctuation. The gall bladder was normal. There were but few adhesions along the under surface of the liver, but the upper surface was rather firmly adherent to the diaphragm. An aspirating needle inserted at the point of greatest fluctuation on the inferior surface of the liver revealed a thick yellowish-brown pus. It was not reddish brown. A specimen was saved for culture and smear. The abscess was opened and was found to be distinctly encapsulated, the wall being about ⅛ inch thick. The cavity was explored, found to be unilocular, i.e., a single abscess, and about 3 inches in diameter.

Procedure: A straight vertical incision as for a cholecystectomy was made. In order to bring the under surface of the liver into view so that the abscess could be drained through the thinnest portion of its wall, the lower free margin of the liver, where the gall bladder was attached, was sutured to the upper angle of the abdominal incision, so as to leave the under surface of the liver in a position vertical to the anterior abdominal wall. With the area well packed off, an incision was made in the thinnest portion of the abscess wall, the liver substance at this site being about ½ inch thick. By bimanual palpation, it was estimated that the thickness of the liver substance above the abscess was about 1½ to 2 inches. Two ½-inch rubber drainage tubes were inserted into the abscess cavity and were sutured to the liver substance to prevent dislocation; the remainder of the cavity was packed loosely with iodoform gauze, a cigarette drain was placed outside of the cavity, all were enveloped in a rubber dam, and were brought out near the upper angle of the incision.

Smear was negative. Culture was negative after forty-eight hours.

Postoperative Course: Uneventful recovery, except for a cystitis which developed following several catheterizations, and which promptly cleared up. The highest temperature was on the first day following operation, 102°F., dropping to normal and remaining so on the fourth day, except for the elevation of temperature associated with the cystitis.

Drains were removed on the seventh day, at which time two small Dakin-size rubber tubes were inserted into the abscess cavity. Daily instillation of Dakin's solution was done at the time of changing of dressing. The patient was discharged from the hospital on November 20, 1926, after being up and about the room for about three days. He has remained well and has gained about 20 pounds.

The pulse rate remained about 40 to 42 until the eighth day postoperative, 54 on the tenth, 60 from the eleventh to the fourteenth, and 70 from the seventeenth day postoperative.

(*No discussion*)

ECHINOCOCCUS CYST OF THE LIVER

HENRY W. CAVE, M.D

Patient, an Italian aged twenty-four years, was admitted to the Roosevelt Hospital, November 20, 1925, with a complaint of pain in the stomach at intervals for six months. He had been in the United States for five years. Previous to that time he had always been in Italy, otherwise his personal history was unimportant. Family history was negative. Present illness began about six months ago after a meal, with a sudden burning pain in the region of the stomach, followed by nausea and vomiting. Entirely symptom-free during the intervals. Each attack has occurred after the evening meal. The attack which brought him to the hospital began ten days prior to admission and lasted continuously for eight days, similar in every respect to the previous attacks except that the pain was much more severe and lasted for a much longer time. He states that his skin has been yellow for seven days, but was never jaundiced before.

Physical Examination: He was a well-nourished young man. Examined very thoroughly, nothing of importance could be found except the jaundice. Blood pressure was 110/70; red blood cells 4,600,000; hemoglobin 85 per cent; while blood cells 12,800; polymorphonuclear cells 78 per cent; blood chemistry normal. Other than bile and an occasional trace of albumin nothing was found in the urine. The roentgenological examination revealed a fairly large area of calcifications in the liver. These calcifications simulated the form of a multilocular cavity. Diagnosis from the roentgenograms: calcification of a multilocular cyst of the liver and deformity of the duodenal cap.

Operation: November 25, 1925. High right rectus incision. Numerous peripyloric and periduodenal adhesions found running to the under surface of the gall bladder and liver, thus accounting for the deformity of the duodenal cap. Gall bladder was grey, thickened and did not empty readily. A thick grating substance was felt within the gall bladder suggestive of sand or fine stones. Gall bladder and adhesions about the duodenum were not disturbed. Well up in the right lobe of the liver onto the dome was found a calcified area approximately 10 cm. by 4 cm. In order to obtain a better exposure of this partially calcified cyst of the liver, the upper right rectus muscle had to be incised straight across and a reversed Trendelenburg position had to be resorted to. The liver was dislodged by traction on the falsiform ligament and packing of gauze well up over the dome and to the right lobe, thus bringing the liver well down to the left into the wound. Clear fluid was then aspirated from the cyst cavity and following this a very careful enucleation of the entire cyst was carried out with extremely little bleeding. The cyst wall was very firm and thickened. A gauze pack was placed in the cavity and brought out through the anterior abdominal wall at the upper angle of the wound. The wound was closed in the usual way. Convalescence was surprisingly easy except for the continuous and profuse bile drainage for sixty days. On January 21 plain roentgen-ray plates covering the abdomen showed no evidence of the cyst previously shown. The patient was discharged from the hospital cured sixty-three days after the operation.

Pathological Report: Echinococcus cyst of the liver.

Postoperative Care: Patient has been seen during the past year about every three months and in every way his cure has been most satisfactory. The interesting features of this case were the firmness and thickness of the cyst wall, the ease with which a complete enucleation was carried out and the profuse and prolonged bile drainge. I understand that in Prof. Alexandra's Clinic in Rome at the present time, where so many of these cysts are operated on, no drainage is being used. The wounds are all closed tight, with good recovery.

Discussion

Dr. William T. Doran: I consider that Dr. Cave was very fortunate in being able to save the life of this patient for so long a time. I had one patient who was apparently well after operation for five years and then suffered a recurrence. I hope this will not occur with Dr. Cave's case.

Dr. Israel L. Feinberg: As to the question of cure, I think this may be doubtful because other cysts may appear with renewed activity. I was recently shown a case in which this condition had existed and there was a question as to the diagnosis. I believed there was an echinococcus cyst of the lung and it subsequently turned out to be so. In my opinion, before this young man is declared cured a roentgen-ray examination of the lungs should

be made to see whether there is any involvement there that may ultimately give symptoms.

Dr. John A. McCreery: I think that Dr. Cave was fortunate to find a localized cyst that could be completely extirpated. At Bellevue Hospital, where perhaps half a dozen cases are seen in a year, it is very rarely that this can be done, the tumors usually being multilocular and too extensive for complete removal.

Dr. Joseph E. J. King: I had a patient in 1924 who had never had any symptoms until he sustained a fall in an elevator, was badly shaken and vomited. Symptoms became acute. At operation an echinococcus cyst was found in the lower lobe of the liver between the gall bladder and the round ligament. It was 3 to 4 inches in diameter and projected slightly from the margin of the liver. I was able to enucleate it completely, but it was so large I could not bring the parts together so I approximated the lower and upper surfaces as closely as possible and inserted a small drain. The wound healed and the patient went home in three weeks and has had no further trouble. That is the first case I ever saw in which the cyst could be entirely enucleated. I think Dr. Cave is to be congratulated on also having been able to accomplish this in his case.

Dr. Cave (closing). Of course my patient may get other cysts in the liver, but the sharp line of demarcation was striking and the entire cyst could be removed without any difficulty. At first I decided against drainage, but it seemed such a large area that I put in gauze.

OBSTRUCTED JAUNDICE DUE TO CALCIFIED LYMPH NODES AROUND THE COMMON BILE DUCT

HENRY W. CAVE, M.D.

This patient, a man aged fifty-four years, was admitted to the Roosevelt Hospital on August 9, 1926, complaining of weakness and jaundice. Family and personal history were irrelevant. Present illness began about five weeks before with slight stiffness of all of his joints, general weakness and indefinite distress after the intake of food. His illness, however, took no definite form until three weeks before admission when he became jaundiced, and had clay-colored stools and dark bile-stained urine. He had lost 20 pounds in the preceding five weeks. There had been no pain and no vomiting.

Physical examination showed a fairly well-developed and under-nourished man who appeared to be ill. His skin and sclerae showed definite jaundice with a slight greenish tint. The abdomen appeared to be moderately full; no masses palpable; the edge of the liver was palpable 1½ inches below the costal margin. Slight tenderness was elicited to the right of the midline in the epigastrium.

A provisional diagnosis was carcinoma of the pancreas. Clotting time was three minutes; blood pressure 118/78; blood count normal.

Operation, August 10. Upper right rectus incision. The liver was found to be somewhat enlarged; approximately three fingers' breadth below the costal margin. It was normal in appearance and in consistency. The gall bladder was not distended appreciably, thin walled, bluish and did not empty readily on pressure. Numerous large hard masses about the size of hazel nuts were felt, which were first taken to be stones within the lumen of the common bile duct. These numerous calcified nodes running along the duct were dissected out and found to have the appearance of small bunches of grapes, all calcified. The entire lymph node seemed to be displaced by calcified small seed-like masses. To be quite sure that there were no stones within the lumen of the duct it was opened and a probe was passed quite easily into the hepatic ducts but with some slight difficulty toward the duodenal end of the duct. However, it was felt that the common duct, which was not distended or thickened, was entirely free from any stones. A small rubber catheter was inserted into the common bile duct through the opening already made and closure of the rent in the duct was made about the tube. A wrapped tube drain was placed down to Morrison's pouch. Head of the pancreas, stomach and duodenum were normal. Nothing was done to the gall bladder.

Patbological Report. Specimen consists of seven pieces of tissue ranging in size from 1 cm. by 1½ cm. to ½ cm. by 1 cm. They are composed of a small amount of fibrous and pulpy brown material, infiltrated with yellowish-white seed-like masses of stony hardness. On microscopical examination they showed the lymph follicles containing germinal centers, the glands infiltrated with well-organized strands of fibroid tissue which breaks the follicles up into patchy groups of follicle cells. Pathological diagnosis was chronic lymphadenitis with calcareous degeneration.

Postoperative Course. The postoperative course was entirely uneventful. The catheter

in the common duct was easily withdrawn on the sixteenth day and bile drainage persisted for about three days longer. The patient was discharged cured with wound healed on August 31, twenty-two days after operation.

Occlusion of the common bile duct from calcified lymph nodes surrounding it is uncommon. In this patient there was no cause that could be found for the chronic adenitis with calcification of lymph nodes. There was definitely no pancreatitis nor any demonstrable disease of the gall bladder and, except for the enlargement of the liver, there seemed nothing in this organ that could have contributed to the adenitis. The appendix was not disturbed.

(*No discussion*)

CARCINOMA OF THE SIGMOID IN A YOUNG WOMAN

HENRY W. CAVE, M.D.

A patient, aged twenty-five years, was admitted to the Roosevelt Hospital on June 9, 1926, complaining of inability of bowels to move, and distended abdomen. Family history was negative. Nothing in her personal history was of any importance. Present illness began four months ago, when she noticed that her bowels would move only with great difficulty and a considerable amount of laxatives. Previous to this time her general health had been excellent. At about the same time that she noticed an increasing constipation she had influenza and during this illness vomited quite often and had a great deal of pain in her abdomen not localized at any particular point. In March she consulted her family physician who made a diagnosis of "inflammation of the womb" for which she was given turpentine enemas. At times since the onset of the illness she had felt feverish without chills. Appetite had been good until a week prior to admission. She has lost considerable weight. Seven days prior to admission she found that her bowels would not move, there was increasing distention of the abdomen and increased tenderness and for the last two days she had been vomiting.

Physical Examination. Patient was a sick-looking young woman with a distended abdomen. Pulse rate was 104; temperature 100.2°F.; white blood cells 10,000, polymorphonuclears 70 per cent; blood pressure 110/80. Preoperative diagnosis was intestinal obstruction, cause undetermined.

Operation, June 9, two hours after admission: Right mid-rectus incision. The large intestine as well as numerous loops of the small intestine were found markedly dilated. There was an increased amount of peritoneal fluid. A large, hard, granulated growth was discovered in the sigmoid, which was fairly fixed, with marked edema and dilatation of the bowel above the growth. A few enlarged glands could be felt in the mesentery of the sigmoid. The liver was found to be negative for any metastatic involvement. On account of the patient's poor condition it was deemed advisable to do simply a cecostomy. At the end of the operation the patient's pulse was very rapid and her condition not good. However, after an infusion she seemed to improve. Cecostomy opening worked perfectly.

Second operation, June 28, 1926, nineteen days after first operation. The first stage of a Mikulicz operation was done through a lower left rectus incision. The annular growth in the sigmoid seemed to have diminished in size since previous operation. The wall of the bowel above the growth did not seem to be so thickened or edematous. The peritoneum at the outer side of the sigmoid was incised and the entire sigmoid delivered up into the wound. A large segment of the mesentery just beneath the growth, where enlarged nodes were felt, was excised and the leaves of the cut mesentery brought together with interrupted catgut sutures. The entire growth was brought well up on the anterior abdominal wall and after careful suture of both limbs of the bowel, wound was sutured. On July 15, the second stage was done with excision of the growth. A few days later a clamp was applied to the loops in order to cut down the spur. Healing then took place satisfactorily up to the point where, on August 21, a closure of the left colostomy was made. Seven days later a closure of the cecostomy was carried out.

Pathological report was adenocarcinoma of the sigmoid; metastatic adenocarcinoma of the mesentery lymph nodes.

Postoperative Course. The patient made an uneventful recovery. She has been seen from time to time since and has gained in weight. Her bowels have been moving regularly and she seems to be in good condition. The case is presented for the reason that growths of the large bowel in young adults are infrequent and also to demonstrate how valuable is a properly functioning cecostomy in the handling of growths distal in the large bowel.

(*No discussion*)

TRANSACTIONS OF THE SECTION OF
GENITO-URINARY SURGERY
NEW YORK ACADEMY OF MEDICINE

Meeting of January 19, 1927

THE CHAIRMAN, DR. FREDERICK T. LAU, PRESIDING

URINARY CALCULI:
WITH SPECIAL REFERENCE TO END-RESULTS

E. O. SMITH, M.D., F.A.C.S.

CINCINNATI

THIS subject is as old as the human race, perhaps older, for the lower animals have urinary calculi. Notwithstanding it is one of the pathological conditions that have been discussed through the centuries, there is ever something interesting and fascinating about the study and treatment of urinary calculi. This may be due to the mystery that surrounds their formation, the certainty of the diagnosis in most cases and the near spectacular of their removal. The young surgeon experiences a real thrill as he locates a calculus and removes it. Perhaps no surgeon, it matters not his age or experience, becomes so indifferent to his work that he does not have a more or less triumphant feeling every time he cuts for, finds and removes a calculus. And besides one has something "concrete" to show the patient.

Urinary calculi were among the first pathological conditions to be relieved by definitely planned surgery. Hippocrates was familiar with this condition but would not operate. He fully appreciated the gravity of the operation, as well as the skill of the specialist, for in his oath he stated: "I will not cut persons laboring under the stone, but will leave this to be done by men who are practitioners of this work."

Discussion of this subject naturally comes under four headings: causes, diagnosis, treatments and end-results. End-results depend largely upon the first three.

CAUSES

Hundreds, perhaps thousands, of pages have been published on the causes of urinary calculi, most of them very interesting, if true. If all of the causes that have been assigned were really active, every man, woman, and child would have at least one urinary calculus, while some of us would have two or three. Too much food, not enough food; too much water, not enough water; hard water, soft drinks and hard liquor. I operated on a man who had consumed about one quart of whiskey a day for the last twenty years, who had only a small calculus in his bladder. If hard liquor is a cause he should have been petrified.

Geological or telluric conditions have been given as causative factors. There seem to be more cases in certain localities than in others. A study of the water supply in some of these districts would lead us to think perhaps it is a factor. For instance, the water supply in the blue grass country of central Kentucky is high in lime salts and it is a well-known fact that at least formerly many persons residing in that locality had urinary calculi. It was in

Lexington, Kentucky, that Dr. Benjamin Dudley from 1815 to 1850 performed 225 perineal sections for vesical calculi.

There are from 200 to 1800 parts of calcium and magnesium bicarbonate to 1,000,000 parts of so-called hard water. When boiled the CO_2 is expelled, leaving only the carbonate which, insoluble in water, precipitates and forms boiler or tea-kettle scales. Of course when these salts precipitate in the urinary tract it is not from boiling; we must look for some other cause. Dr. Swan, who did more than 2000 lithotomies in China, states that the drinking water has but little if any influence. He had the most patients from districts where the water was all right. He concluded that, at least with the Chinese, "poor nutrition, bad hygiene and continuous disregard for laws of health are prominent factors in the causation of stone."

Foreign bodies will precipitate urine salts in practically every case if allowed to remain long enough. And how long is that? A day or two in some, many days or weeks in others. Smooth substances, as glass or very smooth rubber catheters, become covered very tardily while a string (suture), rough catheter or rough foreign body of any material may be surrounded by an appreciable layer within a few days. The process seems very much like the formation of rock candy crystals about a cord suspended in a solution of sugar. What happens when a foreign body remains within the urinary tract? At first there is irritation, then infection. Jumping at a conclusion, one would think it must be the infection that is the cause. Further support of this conclusion may be in the experiment of placing a piece of tin in the bladder with no precipitation of the urine salts, probably because of the antiseptic action of the tin. On the other hand, there are hundreds of urinary tracts that are badly infected, but without stone formation.

Other explanations are that uric acid may damage the epithelium, or bacterial action may cause a catarrhal condition, thus producing organic material for a nucleus. The normal suspension of colloids in the urine may be precipitated by nucleic acid or other acids. Chemically speaking, this is a precipitation of a colloid by an electrolite. Ferments may precipitate fibrin, which in turn may become a nucleus. Experimental trauma of the kidney, such as needling, may produce urinary sand or slight pressure on the ureter may have the same effect. Every urologist has seen many patients who have developed renal calculi subsequent to a kidney injury, also patients with traumatized kidneys who did not develop calculi. Many patients pass uric acid crystals or phosphatic sand for years without becoming victims to calculus formation. If irritation and something solid are predisposing factors, how can such persons escape stone formation? Others, without warning, suffer a severe attack of renal colic, in a few hours deliver themselves of a small calculus which had formed in the renal pelvis and never develop a second. What went wrong in that person to cause a precipitation of a small amount of urine salts in one kidney, this to be delivered, and nothing more thereafter? Did not the other kidney receive the same kind of blood? But its pelvis was not the test tube in which there was a disarrangement of the normal urine colloids and crystalloids which results in stone formation.

Most patients harboring urinary calculi also have infection in the urinary tract, yet it is impossible to determine whether the infection was *propter hoc* or *post hoc*. A moderate sized calculus may be present in the renal pelvis or in the bladder without infection.

Certain agencies must be active to produce, for instance, a calculus in which calcium oxalate predominates, a process which is rather selective. Something happens and another very different salt is precipitated in the same patient in spite of the fact that living conditions and habits have not changed. We know that certain chemical types of stones are found

in acid, and other types in alkaline urine. The stratification of calculi may be alternately one type and the other. Since the concentric layers are not laid down over night, the acidity or alkalinity must have persisted for a few weeks before changing. All this time the patient has been eating the same kind of food, drinking the same kind of water and living in the same environment.

Spontaneous disintegration, or so-called fracture of a calculus, is probably due to a dissolution of the colloid matrix. If the thing that dissolves the matrix had been constantly present there would have been no calculus formation. Here is a suggestion for research work. The discovery, isolation and availability of this something may go a long way toward the "solution" of urinary calculi.

Much study, experimentation and observation by many seems to lead to the general conclusion that the causes are endogenous and not exogenous, that there is a defective or faulty metabolism that alters the colloidal content of the urine, together with a precipitation of the crystalloids, and that is about as far as we have gone. This is a problem of biochemistry. Many authors who have written on the causes of urinary calculi have closed, after a lengthy discussion of some theory, with an apology for not having found the real causes, and with the hope that their efforts would stimulate interest and further research. It is at least somewhat comforting when we fail, to hope that our failure will be an incentive to others to work harder and dig deeper.

A few research workers have contributed something that is worth while and among the most noteworthy is the work of Hager and McGath on the etiology of incrusted cystitis. It seems that their experiments have met the requirements of satisfactory proof. Space does not allow a lengthy review of their work, but suffice it to state they have demonstrated that incrusted cystitis is caused by a Proteum ammoniae which behaves differently from the other six proteus organisms. Proteum ammoniae produces acid and gas in xylose but not in maltose, levulose or sucrose, while Proteum vulgaris, the most common type, acts just the opposite by producing acid and gas in maltose, levulose and sucrose, but not in xylose. If their findings are correct a step toward establishing the causes of urinary incrustations has been made. Unfortunately this is a small percentage of uroliths. Much remains to be done.

DIAGNOSIS

The diagnosis of urinary calculi is easy and certain in most cases. Vesical calculi should never be overlooked if a cystoscope can be introduced. Roentgenograms seldom miss, yet there are a few calculi that do not obstruct the roentgen rays and hence produce no shadow. These are principally the uric acid or urate stones which are more frequently in the bladder than in the upper urinary tract, and therefore can be seen through the cystoscope. Sometimes a stone as large as a date seed will not show on an roentgen-ray film at one examination and will at another, although the intestinal tract had been thoroughly emptied at both examinations. A negative roentgenogram with rather positive clinical symptoms must not be taken as final; several exposures should be made. We have found it helpful in some cases to have another roentgenographer make a film. This is no criticism of any roentgenographer, since one was as competent as the other. I am sure all of us have sometimes found it difficult or impossible to catheterize the ureters of a patient, and at a subsequent examination it was so easy we wondered why we had trouble the first time, or a patient comes with the statement that a previous attempt by another urologist to catheterize the ureters had resulted in a failure, and we accomplish it without delay or difficulty. Feeling our superiority we audibly realized how competent we were and could not understand how the previous examiner,

although a very skilful man, could have failed in such an easy case. Of course this is not a criticism but indirect praise of our own ability. There is an immutable law of averages that should keep us mindful of the fact that the other man has had some of our failures. In some cases the ingenuity of the best urologists is taxed to the limit in making the diagnosis of a calculus. Roentgenograms, cystoscopic examination, ureterograms, pyelograms and wax-tipped catheters must all be skilfully applied in the study of some obscure cases, and then the diagnosis may not be made until the patient comes to the office with the calculus in a bottle.

I need not dwell at length on the subject of diagnosis when addressing a group of urologists. It seems to me that one of our greatest obligations is in the home missionary field. Ballenger looks upon an appendiceal scar as a *symptom* of right-sided urological disorder. His estimate is that 25 per cent of all such cases have had at least one useless abdominal operation. This percentage is a fair composite average of all urologists. Until those who are permitted to practice general surgery are properly trained, it is the urologist's duty to continue his preaching the gospel of careful study and examination of patients before rushing them into a hospital in the evening for an abdominal operation the next morning, except in well-defined cases of emergency. We have been, and will be, misunderstood, charged with ulterior motives, but this should not deter us from discharging our obligations.

The differentiation between cholelithiasis and nephrolithiasis is important and by it disappointment and chagrin can sometimes be avoided.

TREATMENT

All agree that urinary calculi are abnormal, that they cause damage in direct relation to their location, size and number, and that they should be removed. It is not my intention to discuss at this time the various procedures generally used for the removal of these calculi except as they may have some bearing on the ultimate results.

Phosphatic or uratic sand is not a surgical condition, yet through desperation in one case I was guilty of doing a nephrotomy, and establishing continuous drainage through the nephrotomy wound. Frequent ureteral catheterizations had rather definitely proved that but one side was producing the sand. Pelvic lavage and internal medication failed, and so did the nephrotomy. Ten years have come and gone, but this patient is as uncomfortable as ever, at times incapacitated. He is with us yet not because of our treatment but rather in spite of it.

An old treatment of urinary colic and the prevention of calculi prescribed by one layman for another was carbolic acid, in very small doses, of course. Dr. Porter has shown how it really acts as a preventive in a kidney that is throwing out too much uric acid by going into the blood as carbolate of soda and as such meeting the uric acid in the kidney to form soluble urate of soda. Probably it is not very helpful in case of other urine salts. Since patients having phosphatic calculi are usually on a low protein diet, one feels that perhaps that is a causative factor, and a diet containing more proteins is advised. Hinman operated for removal of a ureteral calculus on a child about eight and one-half months old, who had never been given water to drink, only mother's milk and condensed milk. Whether the absence of water was the cause of the calculus or not, all individuals should drink freely of pure water. Just now there seems to be a rather general epidemic of excessive water drinking. Everybody is advocating the ingestion of large quantities of water, not pints, but quarts or gallons daily. I read somewhere a short case report in which the patient, a sufferer from a calculus, used an excessive amount of table salt, therefore sodium chloride is a general cause of calculi! If true, the removal of salt from our daily diet should go a long way toward lessening the number of cases of calculi.

Almost every one with urinary discomfort prescribes alkalies for himself, usually bicarbonate of soda. The medical profession is largely responsible for this general alkalinization of the public. Apparently no one stops to think that alkalies may already be in excess of normal. If an individual is over-alkalinized he may develop a calculus of calcium salts, in which case further alkalies would add fuel to the flame. In such cases acids are indicated. On the other hand, alkalies are indicated in cases of uric acid stones. All this seems rather fundamental, but we are prone to overlook the fundamentals at times. A few years ago Ochsner recommended drinking only rain water to prevent a recurrence. Because several patients had done this and did not have a recurrence the rain water was hailed as a certain prophylactic. It has failed with some of my patients.

Ultimate results following removal of calculi in the upper urinary tract depend on both the operation and the operator. Notwithstanding the fact that statistics seem to show that recurrences are almost as frequent after pyelotomy as after nephrotomy, I am convinced that pyelotomy is to be preferred in all cases where the calcareous material can be completely removed through such an approach. If there is much infection the pelvis can be drained and irrigated for several days through a tube anchored into it. The avoidance of damage to the kidney with primary and a possibility of secondary hemorrhage recommends pyelotomy. In many cases there is no choice and nephrotomy must be performed. The kidney should be handled with the utmost gentleness, care being taken to avoid useless bruising or squeezing, and the incision through the kidney should be as small as is consistent with rapid delivery of the stone or stones. Complete removal of all calculi and all fragments as well as the sand that may be present is very important. Many years ago it was my privilege to observe considerable kidney surgery done by Prof. Israel of Berlin. Following the removal of the calculus he forcibly flushed the renal pelvis through the nephrotomy wound by using a large hand syringe, thus washing out small fragments, sand, mucus and pus. If the kidney showed marked evidence of damage from the calculus and pyelitis a large drainage tube was placed through the nephrotomy wound into the renal pelvis for drainage and irrigation which were continued for a week or ten days. All this seemed so logical to me that it has been frequently used and I do not recall a case of recurrence where this technique was employed. Pelvic lavage through the ureteral catheter following removal of renal calculi theoretically has much to recommend it as a prophylactic measure. To be effective it must be done many times at short intervals. Patients generally do not take kindly to this treatment. They neglect to appear regularly for treatment and of course it fails.

Many cases of silent calculi and of bilateral calculi should not be treated surgically. Unless the urologist feels certain that an operation in such cases will save or prolong life he is not justified in advising operation. Bilateral renal calculi are sometimes discovered by accident, at a time when both kidneys are badly damaged. In some, the best results are obtained by leaving them alone and undisturbed, but of course not in all cases.

If there is any reason why ureteral and vesical calculi should not be removed I can not think of it now. When the patient is unable to deliver these calculi unaided, our duty is evident.

The best results follow the removal of ureteral calculi when there has been a minimum of surgical injury to the ureter and the vesical portion of the ureter is thoroughly patent. The patency can be determined at the time of operation by passing a small bougie through the ureter into the bladder. In some cases it is necessary to introduce a catheter into the ureter transvesically and leave it there many days after the operation. Since there can be no argument about the advisability of

removing vesical calculi, then the only point of disagreement is the method of removal. From the time of Hippocrates to 1561 A.D. vesical calculi were removed through a perineal section. Peter Franco, a French surgeon, about 1561 did the first suprapubic cystotomy for removal of a stone. He had failed to remove a vesical calculus the size of a hen's egg through the perineum of a boy two years of age and was forced to do it suprapubically. The boy lived. For some reason or other the suprapubic approach to vesical calculi did not become popular until rather recent years. Now the choice is between suprapubic cystotomy and litholapaxy. Litholapaxy requires more skill and more time than cystotomy. It has the advantage of a shorter convalescence and a bladder that has not a surgical scar. A second litholapaxy can be done as easily as the first in cases of recurrence, while each succeeding cystotomy becomes more difficult. When there is an enlarged prostate or stricture of the urethra acting as a predisposing factor it should of course be given proper attention. A roentgenogram of every vesical calculus should be made before attempting litholapaxy, as there may be a foreign body within the calculus that can not be handled properly with the lithotrite. In such cases a cystotomy is indicated.

END-RESULTS

In nephrolithiasis the best results are obtained when the calculus is removed before extensive and permanent damage has been done to the kidney. Unfortunately, in some cases considerable damage has already been done before the patient is aware that something has gone wrong. The advisability or urgency of an operation is not proportionate to the size of the calculus as it is sometimes imperative to remove a small calculus that is obstructing the upper end of the ureter, causing the patient great pain and discomfort with concurrent chills and fever, while a larger silent calculus may remain a long time without much disturbance.

Precipitation of urine salts does not take place as rapidly in the upper urinary tract as in the bladder. Some renal calculi do not show much increase in size in months or years, others develop more rapidly, but all grow larger. The calculus that does not interfere with drainage of the renal pelvis is not as harmful as one that does, but eventually pyonephrosis with renal destruction is quite marked, kidney function is diminished, until ultimately the renal parenchyma is completely destroyed. Instead of renal destruction with formation of a pyonephrotic sac, the kidney may be destroyed and in its place a sclerolipomatous mass is found.

The best results in vesical calculi follow litholapaxy when it can be performed. Recurrences will not be frequent if there is complete removal of all fragments. We have seen vesical calculi develop after prostatectomy where no calculus was present before operation. Such a calculus being removed by litholapaxy, was followed in a few months by a recurrence, which was treated in the same manner, even to the third litholapaxy, which terminated stone formation in that patient.

Recurrences. The formation of a second calculus in either the upper or the lower urinary tract after the removal of the first is probably more frequent than we know. Statistics are difficult to gather and therefore are very meager if not misleading. Freyer said recurrences are so frequent that only those cases in which there are serious symptoms should be operated on. Reports vary from 10 per cent to more than 50 per cent of recurrences and uncured patients. Removal of a small or medium-sized calculus through a pyelotomy incision is less likely to be followed by recurrence than when the calculus or calculi are removed through a nephrotomy. Recurrence is more likely to follow operation for multiple calculi than for a single calculus, one or more being overlooked at the time of operation. Failure to remove all calculi and all fragments will soon be followed by return of symptoms. However, this is

not a recurrence, but a continuation. Nephrectomy forestalls any recurrence in the kidney removed, but a calculus may develop in the remaining kidney.

Recurrences in the earlier years of life are more frequent than in later life. Primary calculi occur most frequently between the ages of fifteen to thirty-five years. This may properly be called the "stone age." The conditions, whatever they are, that predispose to the formation of calculi in this period of life, are present after calculi have been removed and may cause a second precipitation of the calcareous content of the urine with stone formation. The cause or causes of calculi not being known, prophylactic treatment and advice so far have been uncertain and unsatisfactory. The amount of lime salts taken into the system can be reduced by drinking only water free from lime salts. The prophylactic value of this measure is not positively established but it can do no harm.

Theoretically, the functional ability of a kidney from which a calculus has been removed would be proportionate to the condition of the kidney at the time the operation was performed. The removal of an obstructing calculus will improve the renal function. Pyelotomy does not mechanically disturb the kidney and the function is not impaired by the operation. Nephrotomy adds damage to an already injured kidney and should be followed by diminished function. Yet patients with but one kidney and upon whom nephrotomy is necessary, have their renal function improved sufficiently to keep them in apparent good health and allow them to follow their business pursuits actively for many years.

In summarizing the end-results of removal of renal and ureteral calculi, it may be stated that although a very large percentage of such cases are not perfectly well in the sense that they have normal kidneys remaining, yet the operation is often imperative and many lives are saved. There are recurrences. The frequency of recurrence depends to some degree upon the thoroughness and completeness of the removal of all calculi and fragments at the time of the operation. A kidney that objectively seems of but little worth will often do valiant service if allowed to remain with the patient. This fact argues rather forcefully for the conservation of a kidney whenever possible. The operative or surgical mortality from the removal of urinary calculi in not high, if sound judgment is exercised in deciding on what is the best thing to do as well as when it should be done, and providing the operation is done with skill and gentleness.

When more is definitely known about the causes of urolithiasis, more certain prophylactic measures against primary and recurrent calculi can be utilized. Until then it will be the duty of the urologist to study each case carefully and do what seems to be indicated for the patient's welfare.

Discussion

Dr. Oswald Lowsley: Whenever Dr. Smith presents a paper it is always complete in detail and most instructive. I appreciate particularly the emphasis he placed on kidney surgery, although I might be tempted to take out some of the stones which he allows to remain. His point concerning removing one kidney and leaving the stones in the other is one that I shall follow more frequently in the future. There have been many methods of determining whether all the stones have been removed from the kidney. At the New York Hospital clinic we make a fluoroscopic examination of the kidney on the table. Quimby's plan of exposing dental films on the table is good, but a still better method has been devised by Dr. I. S. Hirsch of New York. He has devised a fluoroscopic screen that retains the shadow for one to two hours; it can be put in a black box, and the operator can see what is on it without waiting for a roentgenogram to be made.

Ureter operations are becoming less and less frequent, and they should be. This has been brought about by the method of dilating the ureters devised by Dr. Crowell and others, allowing the stones to pass out. If the patient has not persistent fever or persistent, unbearable pain, the ureter should be dilated as many times as necessary to get out the stone. The

ureter operation is a very uneconomic thing. When we open a ureter we have to deal with a cavity filled with urine, usually infected, than which nothing is more likely to cause scar formation, and the result is stricture of the ureter. I have known some very difficult and trying cases. I recall one man at Bellevue who was a constant source of surgery to us because he developed a stricture; we did not use the dilator in those days and we had a terrible time with him. So ureter operations are more to be avoided than any other; but if the patient has fever or unbearable pain, we must operate.

As to stones in the bladder, it seems to me that litholapaxy should rarely be done, for it is more dangeous than suprapubic removal. It was devised when aseptic surgery was not so perfect, and, while it does shorten the stay of the patient in the hospital, it causes trauma and is liable to cause uremia. The study of stones offers one of the greatest fields for research remaining in urology.

Dr. Benjamin Barringer: This has been a very happy and thorough presentation of the subject. Dr. Smith spoke about washing out the pelvis after the operation. That has been suggested by Hunner and some of us believe that his theory may be right in part and stones may be formed by some stricture in the lower ureter. Hunner believed that the ureter should be dilated very wide after the operation. I had a case with the ureter full of stones. The patient was very fat, had a high blood pressure and a good deal of kidney pain, and fever. I did not take the kidney out, which would have been the operation of election. I irrigated it and got it grossly free of stone, and left the kidney in. The patient got along very well, but had subsequent symptoms of sepsis, and the only way to relieve him was to give him wide dilatation of the ureter. I believe this is a very good procedure where one does not do the ideal operation.

Dr. Howard S. Jeck: I can only endorse everything Dr. Smith has presented to us on the subject of urolithiasis, even to his pronunciation of the word *ureter* with accent on the second syllable. I think what Dr. Lowsley has said about conservative methods in dealing with renal calculi should be emphasized. I feel that many kidneys whose drainage is interfered with by calculi, to the extent that they seem hopelessly lost, will come back if given a chance.

I also agree with what Dr. Smith said concerning Dr. Ballenger's sign, and this reminds me of Dr. Keyes' axiom: "The operation for chronic appendicitis is frequently justified by the subsequent silent passage of a stone from the right ureter."

Dr. Nathaniel P. Rathbun: I too extend my congratulations to Dr. Smith for his excellent presentation and particularly for being able to compress so much that is interesting and instructive in a relatively short paper. I subscribe heartily to what he said about the importance of educating the general surgeon up to an appreciation of the necessity of requesting a urological survey before subjecting patients to operation for obscure abdominal pains. I do not think that any of the surgeons in the hospital where I do my work would consider opening an abdomen in such a case without such an examination.

I go a bit further perhaps than Dr. Smith does, in not being contented with a simple roentgenogram, but advising a complete examination, including roentgenography, cystoscopy, pyelography and ureterography, all at the same sitting. It seems to me that in this way we save a great deal of time and even get a great deal of information that we would not otherwise get. We learn the type of pelvis with which we are dealing, which might influence us in selecting the type of operation for a given case. Furthermore, we get considerable information as to the amount of destruction that may have gone on in the kidney and the pyelogram will often indicate even better than the dye tests the functional capacity of the diseased kidney.

The only possible exception I can see to a routine pyelogram is the remote possibility that it might do some damage and inasmuch as we do eight or nine hundred pyelograms every year in our clinic and we have no serious reactions, this is obviously not much of a factor.

I agree with Dr. Smith's conservative attitude about some of these bilateral calculi, although I am frank to confess that I should have operated on some of them.

One or two little points about ureter calculi: I believe that the great majority of them pass spontaneously and most of the remainder will pass following simple dilatation, leaving only a small minority that require operation.

I believe that the position of small stones in the ureter, those a centimeter or less in diameter, as indicated by repeated roentgeno-

grams, is a very important point in determining the procedure. If the position remains absolutely the same, after repeated roentgenography, it is fair to assume that the stone is fixed and will not pass as a result of simple measures. I have operated on a few such cases and found the calculus so firmly imbedded in the mucosa that no amount of dilatation would have moved it.

I believe that a routine roentgenogram immediately before operation is a valuable point. I have been embarrassed by failing to find a small stone at pyelotomy and subsequently finding it well down in the ureter.

I think it is tremendously important to make some kind of roentgen-ray examination on the table immediately following operation. The method that Dr. Lowsley mentions is very interesting. We use the fluoroscope.

Dr. Smith said the results depend on the operation and the operator. I think we might add to that the after-treatment. Many of these cases are complicated by ureter stricture and it is important that we provide for adequate drainage following operation. This can be done by simple dilatation. In fact many cases continue to complain of their previous symptoms in the absence of any recurrence of calculus, and because the presence of ureter stricture.

Dr. Clarence G. Bandler: All of us, I believe, are practically in accord with Dr. Smith's views, except with his statement that "in most cases of ureteral calculi the calculi should be removed." It is evident that we think that ureteral calculi should be operated upon only as a last resort, and that they should be given a chance to pass either spontaneously or by manipulation. It is well known that 70 per cent of ureteral calculi will ultimately pass or can be made to pass.

Well worth considering is Dr. Rathbun's statement that in all cases of calculi in the upper urinary tract the after-treatment of the ureter is of the utmost importance. Dilatation of the ureter will in many cases prevent the reformation of stones and frequently a calculus that has escaped observation will pass spontaneously after this manipulation. I have seen a number of examples of this sequence of events.

The question of bilateral calculi is of great importance. It has interested me for a long time, and I have come to the conclusion that the less surgery one does in cases of bilateral multiple calculi the better and longer will the patient live. Formerly our tendency was to operate immediately on the less damaged of the two kidneys in order to remove stones and give the kidney a chance to improve; and at a subsequent operation to remove the more severely damaged kidney. I no longer adhere to this practice, but prefer to avoid surgery in these patients; and they certainly survive longer.

Dr. Julius J. Valentine: I cannot agree with Dr. Lowsley in his stand against litholapaxy, which Dr. Smith advocates. Some of us still perform the operation. I believe it to be definitely indicated in selected cases. A moderate-sized stone that is free in a bladder not too inflamed or too badly infected, can be crushed by gentle manipulation. A reasonable amount of skill is required and good tactile sense is also necessary. I do not think that cases of this type should be subjected to suprapubic cystotomy for removal of the calculus.

Dr. Henry D. Furniss: I, too, thank Dr. Smith for his excellent paper and add my endorsement to what the others have said in regard to ureteral stricture. The strictures found in stone cases are not usually a result of calculi. It is more probable that the calculi arise as a result of stasis from faulty drainage consequent upon the stricture. We will have few recurrences after stone removals if we establish proper drainage by ureter dilatation, and remove the pelvic infection by suitable treatment. Strictures have a tendency to recontract, and the patient must be kept under observation and treatment for years, or sometimes for the rest of his life.

Dr. Smith showed some stones from patients who had referred pain to the other side. I do not think it is wise to say that a patient has referred pain from the other side. I had a case where a patient had no pain on the stone side but only on the other side, where there was a stricture and a 10 ounce hydronephrosis. So we should not accept referred pain until every urological procedure has been exercised to rule out disease on the symptom-producing side.

Dr. Leon T. LeWald: I was particularly interested in Dr. Furniss' last remark, apropos cross symptoms. I have seen errors come about by not marking the right and left side of the roentgen-ray film, resulting in disaster. If the roentgenologist fails so to mark a double-coated film, no one can tell which side the shadow is on. And to make the situation still more complicated, it must always be borne in

mind that in transposition of the viscera, the kidneys are also transposed. I have personally seen 35 cases of this sort.

The question was brought up by Dr. Lowsley about the three methods of using the roentgen-ray in the operating room. Personally, I think I would rather use a film. It gives a record, and the silver emulsion on the film is more sensitive to the eye than the fluoroscopic image. That would, of course, apply only to some minute fragment of stone or a uric acid stone which might cast a very faint image. With the film, one has a permanent record of the condition of the kidney and by it can prove that he had removed all fragments of the stone. While with the fluoroscope alone or the more recent suggestion of Hirsch, mentioned by Dr. Lowsley, whereby the surgeon views the fluoroscopic image impressed for some minutes or hours on a so-called "lag screen," there is no record for future use.

Dr. J. Sturdivant Read: I agree with what Drs. Smith and Valentine have said about the harmlessness of litholapaxy in suitable selected cases. It is frequently preferable to any open operation. Dr. Smith's presentation of the subject of kidney stones has been most instructive and his emphasis that there are many cases of large stones in both kidneys which do better if they are not interfered with by operation, is needed. Many of these cases have been watched by me over many years and when there are no symptoms of continuous and unbearable pain, or no frequent attacks of colic, and yearly roentgenograms do not indicate a marked growth of the stones, I believe that they should not be disturbed. Many of these patients present symptoms of chronic indigestion at irregular periods. I have found that dilatation of the ureters and lavage of the kidney pelves, two or three times a year, will often control these symptoms.

Dr. Joseph L. Boehm: I wish to direct the attention of the members to the best monograph on stones I have ever read, written by Prof. Dr. H. Nakano of the University of Tokio. He studied in Europe and devoted himself to this subject. I think this volume should be in every urological library.

Dr. Frederick T. Lau: Concerning the management of renal calculi it would seem that the pendulum of opinion swings first one way and then the other. At one time it was quite the accepted thing to perform a nephrectomy on the kidney whose function and structure had been deteriorated by a stone.

Realizing the great capacity of a kidney to restore itself to better function following the removal of an impairing cause, such as a stone, one cannot help wondering today, upon seeing a calculus in a remaining kidney, just how much function would have returned in the other kidney, sacrificed by nephrectomy because of the presence of stone.

I cannot help recalling, at this time, the result of an intensive study made by me several years ago at the New York Hospital of the cases of recurrent calculi covering a period of ten years. Each of these cases of recurrence presented some form of stasis and some form of infection, thus emphasizing the necessity of dilatation and lavage in preventing recurrence.

Dr. Smith (closing): I thank the discussants for the many complimentary things said about my paper, and also for the few differences of opinion.

My reasons for the adoption of litholapaxy were given in the paper. True, it requires more skill to crush a vesical calculus than to perform a suprapubic cystotomy, yet the advantages to the patient justify the development of such skill. When properly done litholapaxy is perfectly safe.

After the removal of a calculus from the ureter a bougie should be passed retrograde into the bladder in order to dilate any stricture or ureteral angulation that may be present. If there is marked obstruction the bougie may be left in place for several days. Weeks or months later transvesical dilatation of the ureter or an indwelling catheter may be necessary to establish free drainage into the bladder and close the ureteral opening made when the stone was removed. If there is an ureteral stricture it will behave about the same as urethral stricture and will need repeated dilatations.

I entirely agree with Dr. Jeck as to the value of a urological examination of all patients who have vague abdominal pains. Valuable information is thus obtained and the location of the lesion often determined. The various methods used in making such an examination should be employed in complex cases.

Some of the ureteral and pelvic calculi are very elusive; they are not where previous roentgenograms seemed to locate them. Fluoroscopic examination during the operation is very difficult, and requires skilled help to do it accurately. I saw Quinby put the small roentgen-ray plate in the surgical wound

behind the kidney and the developed film was helpful in locating a small calculus. By using a table with a built-in Bucky diaphragm when kidney surgery is done, roentgenograms can be made at any stage of the operation to aid in locating the stone or just before closing the wound to determine whether all stones or fragments of stone have been removed.

If I gave the impression that all ureteral calculi should be cut down upon and removed surgically I did not intend to do so. Ureterotomy is indicated when it is obvious that the calculus is too large to pass into the bladder, or after repeated efforts to bring it through the natural channels have failed.

Pain is not frequently referred from the pathological to the normal kidney, yet when a pathological condition has been corrected in one side and the pains that were in the opposite side are relieved there seems no explanation but that of referred pains.

PRESENTATION OF SPECIMEN AN UNUSUAL URETERAL STONE

I. C. RESHOWER, M.D.

(By invitation)

This specimen is presented merely as a freak of rare occurrence. No ureteral stone nearly its size has been reported, but Hugh Young mentions one about the size of a small cigar.

This patient passed a thin stone, three inches long, twenty-five years ago. She has had three children, all difficult labors, and two miscarriages. During one of these pregnancies she had severe nephritis and passed bloody urine.

On April 28, 1926, she suffered severe paroxysmal pains on the right side, radiating down the back and to the pubes and a dull backache on the left side, with dysuria and urinary frequency. On June 1, 1926, a roentgenogram was taken (Fig. 1). A few days later, after the pain had somewhat lessened, cystoscopy revealed a very much distorted bladder, with a large pouching on the left side, which was difficult to enter with a catheter. The right ureter was easily entered, but an obstruction was encountered at about the junction of its upper and middle thirds. Pushing by this obstruction and using suction, a small amount of syrupy fluid was brought down. Chemically it was nearly pure uric acid.

A phenolsulphonphthalein test at this time showed no color from the right ureter; but it came through at another point rather high on the left side in nine minutes. It was very evident from this that there was more obstruction from the small stone in the right ureter than from the huge one in the left, which was porous and laminated, as the specimen shows. After several dilatations of the right ureter the smaller stone passed. At one of these cystoscopies the left ureter was entered and a No. 3 catheter was passed by the larger stone with difficulty. Injecting a few drops of liquid petrolatum aided much in accomplishing this.

Fig. 1.

At no time was the left ureter blocked by the very large stone, but the small stone blocked the right ureter and caused the hydronephrosis seen in the roentgenogram. With the passing of the smaller stone the patient was fairly comfortable and refused further treatment.

On September 5, after a long automobile ride and a very active day, she was taken with severe pains in the left side and back, vomiting and sweats. I was away at the time. Dr. J. Edward Dolan, who had been following the case and knew its history, was called; and he operated the next day. Through a lumbar incision about 5 inches in length, the left ureter was exposed and opened. The ureteral wall

over the stone was ⅛ inch thick. Gently rotating, the stone was extracted. The lower 1½ inches of the ureter was sewed with chromicized gut, a tube drain was placed in the upper opening, and a periurethral drain was inserted.

Convalescence was good up to the thirteenth day when the patient developed a temperature of 104°F. This subsided in a day or two with the passage of a large amount of pus from the bladder. She left the hospital eight days later and has been very comfortable ever since. She has no urgency and only slight frequency.

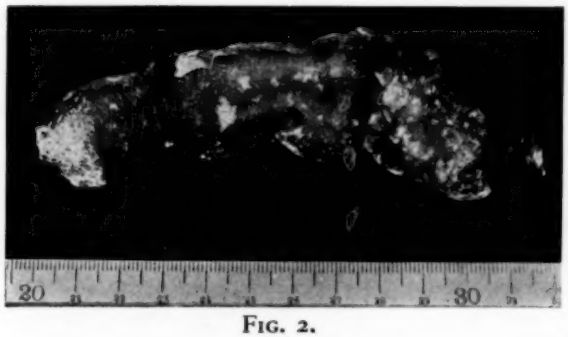


FIG. 2.

Urinalysis shows pus, and a few granular and hyaline casts.

On cystoscopy two days ago (January 17, 1927), the left ureter, almost at the top of the bladder, was entered with difficulty, and the pouch caused by the stone is still evident. Function tests show color in about eleven minutes at both ureter openings. This delay I attribute more to the nephritis than to obstruction.

Discussion

DR. LOWSLEY: This is a most interesting case. I have never seen a stone like it. It is of most unusual size, and I congratulate Dr. Reshower upon being able to show it and upon his result.

DR. B. S. BARRINGER: Did Dr. Reshower get the catheter up the ureter through to the kidney? It is a very interesting point, if you can save the kidney.

DR. LAU: Was a pyelogram made?

DR. RESHOWER: No pyelogram was made. Cystoscopy was done in the office and we had no facilities for making a pyelogram there.

Replying to Dr. Lowsley—credit must not be given to me; most of it should be given to Dr. J. E. Dolan. There was quite a little difficulty in removing the stone, and he had to rotate it almost as if we were taking out a tight sound.

PRESENTATION OF NEW APPARATUS AND INSTRUMENTS

A NEW TUBE FOR SUPRAPUBIC SUCTION DRAINAGE OF THE URINARY BLADDER

FRANK W. HARRAH, M.D.

(By invitation)

It has been the practice for a number of years at the James Buchanan Brady Foundation of the New York Hospital to drain the urinary bladder for a suitable period of time through a suprapubic incision by the use of a suction apparatus. This practice is followed principally in cases requiring a subsequent prostatectomy and, more recently, in some cases of external urethrotomy, with the sole idea of reducing the patient's toxicity more efficiently and more rapidly than by the use of syphon drainage of the bladder through the urethra or otherwise, as manifested by a gradual increase of the phenolsulphonphthalein output, a decrease of blood urea nitrogen and a steady improvement in the patient's general condition, all of which are accelerated by an adequate intake of fluid.

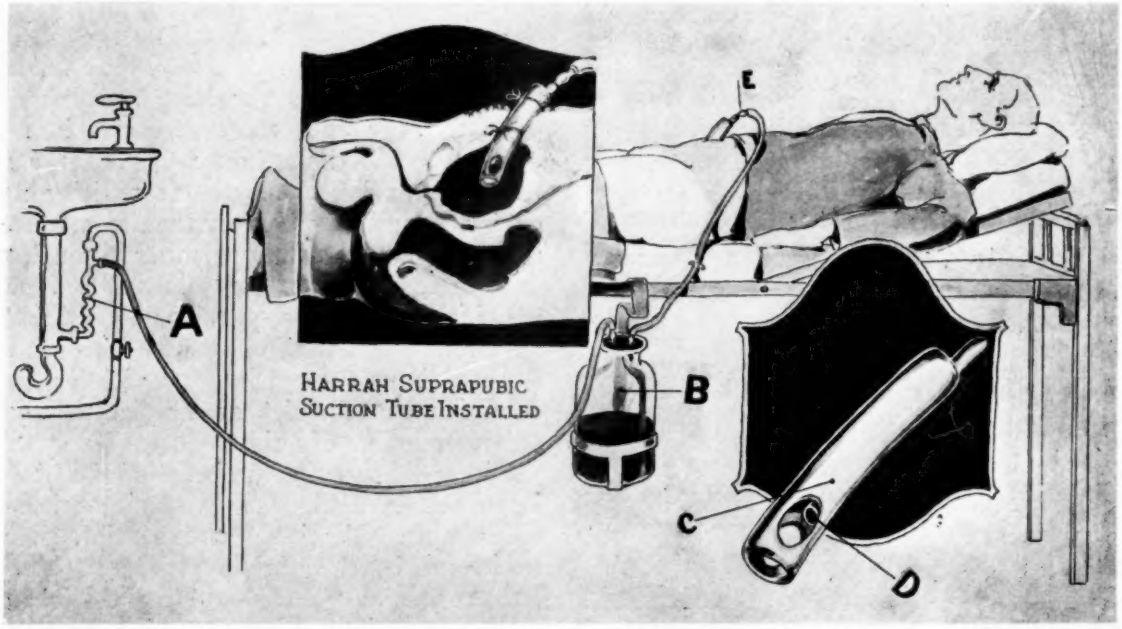
Suprapubic suction drainage of the bladder is, of course, not new, but the fact that the method of application of the principle has not been as satisfactory in the past as it seems to be at present renders one enthusiastic and eager to try something a little different.

Practically all cases drained by the suction method in our experience present wounds that are healthy, dry and clean and devoid of the foul, ammoniacal odor of decomposed urine. It seems that in cases of prostatic obstruction, where the patient is old and feeble, with or without complications such as a bladder diverticulum, and having badly damaged kidneys, a chronically infected bladder, or both, suprapubic suction drainage acts in a very gratifying manner by clearing up the infection and foul odor of the bladder and increasing the resistance of the patient. Thus it diminishes the amount of urea nitrogen in the blood and creates a more satisfactory renal function than any other method of drainage with which we have had experience.

Furthermore, the bladder is drained thoroughly of all its infected residual urine; the opportunity of an ascending infection through frequently dilated ureters is lessened and the

edema of the prostate and the bladder tissues subsides to a marked degree. The patient feels comfortable and since the operation is performed under local anesthesia, he is subjected to little if any shock.

It appears that suction drainage of the bladder is of paramount value especially in such extreme cases as all of us so frequently see. We know that syphon drainage of the bladder permits a constant residuum; that the opening at the terminal end of the catheter frequently becomes obstructed with blood clots, detritus, etc., causing either distention of the bladder or wet dressings and bed linen, which make the patient unhappy by their offensive odor, and render frequent change of dressings imperative.



The accompanying diagram illustrates the principle of the method of suprapubic suction drainage of the bladder as employed at the New York Hospital by the use of Bunsen water suction pumps, marked (A) in the diagram, attached to the water pipes in every ward and room. With water for pressure a partial vacuum is produced in the system, and the apparatus functionates accordingly; the urine being collected in the container (B).

A No. 20 Eynard rubber tube (C), 15 cm. in length, with inside diameter of 1.75 cm., presents two oval shaped lateral fenestrae, each 1.5 cm. in length and 1 cm. in diameter. These are placed 1 cm. from the terminal end of the tube, which is open, and which is 1.75 cm. in diameter. There is another rubber tube (D) 17.5 cm. in length and 1 cm. inside diameter, vulcanized to the inner wall of the outer rubber tube in such a manner that the lower extremity of the inside tube, which is oval shaped, is on a direct horizontal with the upper aspect of the two lateral fenestrae of the outer tube. The inner tube projects 5 cm. above the upper extremity of the outer tube, in order to facilitate the connection with the remainder of the apparatus. An air space 0.5 cm. in diameter is therefore left between the inner and outer rubber tubes in order not to create a complete bladder vacuum with its associated pain and subsequent stoppage of the plant. This air space is also used for irrigation of the bladder while the suction apparatus is at work, thus keeping the bladder in a healthy and aseptic condition. Such irrigation is practiced in our wards twice daily in all bladder drainage cases, with excellent results.

If by chance the inner tube becomes clogged with clumps of devitalized bladder tissue, phosphatic deposits, blood clots, etc., the tube can readily be cleaned without removing it from the bladder by simply disconnecting the suction at the point (E), inserting a long grooved director through the lumen of the inner tube and twisting it about several times. Upon withdrawal of the director, the groove is found to be filled with the sediment which had collected upon the wall of the inner tube. However,

such a procedure is rarely necessary, especially if several syringefuls of boric acid or acriflavine solution are forced down into the bladder between the tubes every morning and evening while the suction is on. This sort of irrigation is of great value, not only for mechanical reasons but for therapeutic results in keeping the interior of the bladder clean.

These suction tubes are made in France in size Nos. 20 and 24, the latter being of larger caliber than the one described above.

The old style rubber suction tube devised by Kenyon at the New York Hospital many years ago would frequently cause the patient much distress, for the inner tube would often slip down and impinge upon the mucosa in the region of the bladder neck. These patients would complain of pain at the end of the penis and loss of time and discomfort were involved in reinstalling or adjusting the tubes. These tubes were held together by rubber bands, safety pins or adhesive tape, rather than being of a single unit.

The suction tube functionates best when inserted into the bladder for a distance of 1.5 cm. to 2 cm. above the lateral fenestrae of the outer tube, with the air space between the two tubes facing anterior to the inner tube. The tube should be placed in the uppermost aspect of the bladder and fastened securely to the bladder wall with catgut, tied around the tube. The tube is then brought out through the extreme upper angle of the suprapubic wound where it is again fastened to the skin by tying a silkworm-gut suture through the skin and then around the tube. A cigarette drain to the space of Retzius is placed just anterior and below the suction tube.

The suprapubic suction drainage here described effectually removes fluid as it accumulates in the bladder, without any spilling, overflow or odor of urine in the ward; it allows for a large amount of air to circulate through the bladder, which in itself inhibits the growth of many bacteria, and drys and heals the inflamed bladder, in a satisfactory and efficient manner.

Discussion

Dr. J. H. Morrissey: Dr. Harrah has accomplished a great deal by simply vulcanizing the inner tube to the outer tube. Heretofore the difficulty with the suprapubic suction arrangements has been that the inner tube was liable to slip down in the bladder and impinge upon the bladder neck. It was fastened either with a safety pin or with a simple piece of rubber which would not hold it. This principle of suction drainage on a large scale is made possible only by my own suction drainage apparatus which I have never described; and I take this opportunity to do so, if I may.

It is a combination of the ordinary Chapman water pump and the plumbing system of the institution. One reason that we do not use more suction is that it is not available and one may not attach the water pump to the faucet and leave it running continuously. At the New York Hospital we have an arrangement where the water pump is incorporated into the water system by an extra feed-line and then attached directly to the waste without running through the bowl. Two hand valves control the flow and the apparatus can be utilized without interfering with the regular toilet facilities. These pumps cost about three dollars and the plumbing can be put in by the institution employees. We have twelve of them in the hospital and have equipped all rooms with them and are thus able to get good suction. Syphon drainage when it is properly taken care of is most satisfactory, but a group of ward cases to which one cannot give personal attention will be kept drier and much more comfortable with a good suction apparatus and tube.

Dr. J. Sydney Ritter: On the urologic ward at the New York Post-Graduate Hospital, we use suction drainage for our bladder cases. The water suction is produced by the use of the old Sprengel type pump. These are located in an anteroom adjacent to the ward. From this point, suction is carried to each bed in the ward by means of a small caliber metal tube. For our private room service, we use an automatic, interrupting, high-speed, electric pump, devised by Dr. Joseph F. McCarthy and myself. This is a portable outfit.

Regarding the suction tube of Dr. Harrah, I feel it best to have a removable inner tube, because blood clots and débris plus deposits of salts necessitate the daily removal of the inner tube for cleansing purposes. Should the inner suction tube become plugged, it is necessary to remove the entire suprapubic drainage tube, which is not desired within the first forty-eight to seventy-two hours. At the Post-Graduate we have had little difficulty in keeping our inner rubber tubes in position by means of safety pins when this type of tube was used.

We use a mushroom catheter cut to fit a metal inner tube I devised about one year ago.

This metal tube has numerous perforations placed in a spiral manner so that should one become plugged the lower ones would continue to function. This long tube is passed through a metal button with a central perforation supplied with a rubber bushing, so that the suction tube may act as a plunger using the button as a fulcrum. This button has a second channel that opens on the side. This is the inlet channel, allowing the air to enter so as to avoid the production of a vacuum within the bladder; thus avoiding traumatizing the surrounding tissues. Due to the fact that the mushroom of the Pezzer catheter is difficult to introduce unless placed on the stretch, the suction tube can be pressed down, using the lateral arms of the button for the counterpressure, placing the mushroom on the stretch and making it easy of introduction and removal. The metal inner tube avoids the possibility of collapse which occurs when soft rubber tubes are used. By means of the inlet located on the button of the inner tube, we are doubly protected, in that should the suction stop for some unknown reason this inlet serves as an outflow for the urine. The tube may be inserted on the operating table.

After six to ten days, when a definite suprapubic fistula has been established, this tube is of no value, for it prevents closure of the bladder. We then use the Gile tube, which is composed of small inner and outer perforated metal tubes suspended from a circular plate. This tube is 1.5 inches long and does not extend into the bladder, thus allowing the latter to close.

A CYSTOSCOPE FOR FULGURATION OF BLADDER TUMORS

OSWALD S. LOWSLEY, M.D.

(Author's abstract)

In this recently devised instrument, the telescope is based upon the McCarthy lens system, the result being that it deflects the angle of the optical axis 25° instead of the customary right angle. The advantages claimed for the instrument are:

1. It is small and easily passed into the bladder.

2. The telescope and light are contained entirely within the shaft of the instrument, thus allowing the greatest possible motility in the conduct of intravesical fulguration.

3. It has a large metal electrode at the end of the curved portion, size 22 F, which causes extensive disintegration of a tumor mass under vision. This electrode is thoroughly insulated.

4. Continuous irrigation through the fenestra is possible, which insures a clear field at the point of application of the spark, even in the presence of considerable hemorrhage.

5. The forward or oblique-looking lens system of McCarthy makes it possible to keep the electrode in the field of vision at all times.

6. The expense of the instrument is greatly reduced by the fact that any McCarthy telescope can be used in it.

AN IRRIGATING CYSTO-URETHROSCOPE FOR APPLYING HEAT TO THE PROSTATE AND VESICAL ORIFICE UNDER VISION

OSWALD S. LOWSLEY

(Author's abstract)

The object of this instrument is to apply heat under vision to the prostate and vesical orifice in an attempt to ameliorate not only ordinary chronic inflammatory lesions of these structures but all diseases of the prostate and posterior urethra. By it heat is intended to be applied under vision to such a degree that a draining of the tissues will result, thereby insuring permanent as well as temporary relief of symptoms.

The advantages claimed are:

1. The instrument has a large electrode for the purpose of applying heat in such quantities that a vigorous drainage of the prostate and vesical orifice results.

2. Its action is observable during the heating process.

3. Provision is made for constant irrigation.

4. Any McCarthy oblique vision telescope may be utilized in this instrument.

Discussion

Dr. Leo Michel: Dr. Lowsley is, as usual, very ingenious. The fulgurating apparatus seems to me to be a splendid instrument where one wants to apply a large surface and can reach a point for fulguration. Often in bladder work I have tried to reach a spot that I could not touch with the shaft of my instrument or the end of the instrument; I could not reach it with either the Bugbee or the McCarthy electrode. I have never used this instrument, but say this because of my experience with other instruments.

Concerning the diathermy apparatus, I would like to know what Dr. Lowsley means and what advantage he gains by observation under direct vision of the application of heat. He has, too, a small surface through which he applies the electric heat. I would like to know where he applies the indifferent pole, and under what conditions he uses this apparatus. The application of heat requires a larger surface than Dr. Lowsley's instrument can give. I cannot visualize the advantages of the direct vision of heat application, for if one gives sufficient heat to create a burn he is not doing his patient any good. One cannot apply heat enough to give a burn, for when the patient is uncomfortable the operator must cease; and under these circumstances visualization of the heat application is not necessary, and is impossible. If Dr. Lowsley desires to apply diathermy to a very limited area under observation in the posterior urethra with this instrument, I can understand its use; but its construction does not admit of the proper application of diathermy to the prostate. I truly cannot see the advantage of the instrument.

What does Dr. Lowsley see with his instrument? We have at present electrodes for the application of the various electric modalities to the posterior urethra and the very limited prostatic area which these electrodes reach, exactly similar in construction to the Lowsley electrode except that he gains vision, as he describes it, for the application of diathermy. How can one see diathermy or heat?

Dr. Jeck: I should like to ask Dr. Lowsley whether he has tried his new fulgurating cystoscope in bladder neck conditions, such as a median bar. I did not understand whether or not he thinks it is applicable to that type of operation.

Dr. C. W. Collings: I think Dr. Lowsley's fulgurating cystoscope may be usefully applied to large papillary tumors of the bladder with a large pedicle. With a large electrode and a strong fulgurating current large tumors may be destroyed the more quickly. I would like to know what type of machine he uses.

Dr. Lowsley: I appreciate the discussion of these new instruments, realizing that it is difficult to discuss a thing with which one has had no experience. Dr. Michel has made some very appropriate remarks. The mobility of the fulguration instrument is very practicable. I have not tried it on a great number of tumors myself, for I devised it only within the last few weeks; but where I have tried it I have had no difficulty in reaching the tumors. I can easily see how a small tumor way up in the bladder might not be easily reached, but that is very rare, so I think the mobility is very satisfactory.

Dr. Michel's criticism of the diathermy instrument may be well taken. I do not know so much about diathermy. I have felt that the devices used heretofore were blind. There have been many different reports regarding diathermy. They claim that when the tissue is properly heated there is an edema and an exudation of fluid.

The urethra runs through the prostate. You can apply heat to the prostate through the urethra. If you apply heat to the posterior urethra, it affects the prostate. The electrode at the end of the shaft of this instrument presents quite a large surface and a current of 600 ma. to 700 ma. is sufficient to get a good drainage reaction. I do not think this is valuable for every prostate but it is for that type of prostate which does not respond to the ordinary treatment.

Dr. Jeck spoke of the bladder neck keratoses. I do not approve particularly of applying this instrument to bladder neck lesions, because while one can see perfectly well inside the bladder one really cannot see very well just inside the neck. Theoretically, according to our other McCarthy instruments, it should allow vision there, but unfortunately it is practically valueless.

EDITORIALS

THE MOVING PICTURE IN MEDICAL TEACHING

MORE than twenty years ago, when the moving picture was still in its infancy and bore the name, in this country, of "vitascope," we ventured an editorial prophecy (The JOURNAL, May, 1906) on The Stereoscope, the Vitascope and the Phonograph in Medical Teaching. Therein we said: "The vitascope serves to dissect and to delineate the composite acts involved in the normal movements of animals and of human beings. Why not also abnormal movements? The question at once suggests a wide range of diseases in which abnormal gait (coxitis, tabes, spastic paraplegia, pseudo-hypertrophic muscular palsy, etc.), irregular muscular activities (chorea, athetosis, paralysis agitans, myokymia, nystagmus, etc.), and convulsions (hysteria, epilepsy, eclampsia, etc.) can, by means of moving pictures, be permanently recorded in every detail for comparative study and comparative demonstration. Many surgical procedures involve certain details of technique not always easily made clear by description or by means of photographs, etc." At that time a few moving pictures had been made by or for individual physicians or surgeons, but they were only crude novelties. As years went on other physicians experimented with the cinema, but the efforts, although rather more successful, were still only sporadic.

Ten years after the first we wrote another editorial (The JOURNAL, March, 1916) on The Teaching Value of the Moving Picture and the Phonograph in Surgery, to which we gave the subtitle, A Prophecy in Fulfilment, because at that time "The Clinical Film Company" of New York was producing some excellent moving pictures of surgical, including dental, operations, was developing the nucleus of a valuable collection of these, and had exhibited them or loaned them for exhibition before many medical societies and college classes. Their work gave great promise of practical success. But the expenses of experimentation, of free picture-taking and demonstration, were very large, and the cost of this pioneer work in introducing moving pictures into medical teaching on a large scale was probably too great for a limited private enterprise. At any rate, this and one or two other such commendable commercial ventures were abandoned.

Another decade passed without the establishment of the moving picture as a regular part of medical teaching. All its obvious advantages as to clearness of demonstration, size of audience, permanent preservation, have thus far gone unutilized so far as any systematic plan has been concerned. Now, however, such a plan is in sight. At the last meeting of the American College of Surgeons in Montreal a committee was formed to formulate procedures for the development of the cinema as an adjunct to medical teaching. In December, 1926, the committee met in Rochester, N. Y., with Will H. Hays, president of the Motion Pictures Producers and Distributors of America, George Eastman, head of the Eastman Kodak Company, and several other representatives of that company, and initial working plans were adopted. Mr. Eastman offered the technical resources of his Company and the cooperation of the School of Medicine and Dentistry of Rochester for experimental efforts. Thus can be solved all the lighting and photographic problems that are involved in this special field of work; but such excellent pictures have been taken in years past

that we feel sure these problems will present no great difficulties. Started under such auspices, and with the dynamic Director-General of the American College of Surgeons to push the beneficent enterprise, it will probably not be many years before our medical schools have complete film libraries of standard surgical procedures as performed by their originators or by the leading surgeons of the world.

With color photography, motorial and certain tropical diseases may be brought close to any student and may be studied again and again. In place of the few craning their necks in a surgical amphitheater to get an occasional glimpse of an operation, usually at a distance of several feet, the moving picture, enlarged to any desired size, will show to hundreds comfortably seated every step of the operation in clear detail. The technique may be emphasized by "the slow motion" device, and the tissues can be seen in their natural colors.

The phonograph, that other great invention of Edison, will not be needed, but the "vitaphone," to the development of which he also made important contributions, can be a part of the film wherever needed or desired. And so, without travelling to Philadelphia, Boston, Cleveland, hundreds of students and physicians may see the nimble fingers of Deaver perform a laparotomy and hear the whimsical comments of that veteran teacher, may watch Cushing perform, and demonstrate with scholarly diction, the removal of a brain tumor, may stand beside the dextrous Crile while he skilfully operates upon a goiter and while he discusses his methods and discourses upon anociation. The fingers and the voice of Chutro in Buenos Aires, Bastianelli in Rome, Jones in Liverpool, will be seen and heard in the schools of Chicago and San Francisco. And they will be seen and heard in the classrooms by future generations of students when these surgical masters are no longer living.

W. M. B.

[SURGICAL SUGGESTIONS]

IN SOME individuals it is exceedingly difficult to enter a needle into a vein at the elbow. The veins on the hand, a saphenous vein or, better still, the veins at the ankle can then be used. In infants, of course, the longitudinal sinus at the anterior fontanelle, is available.

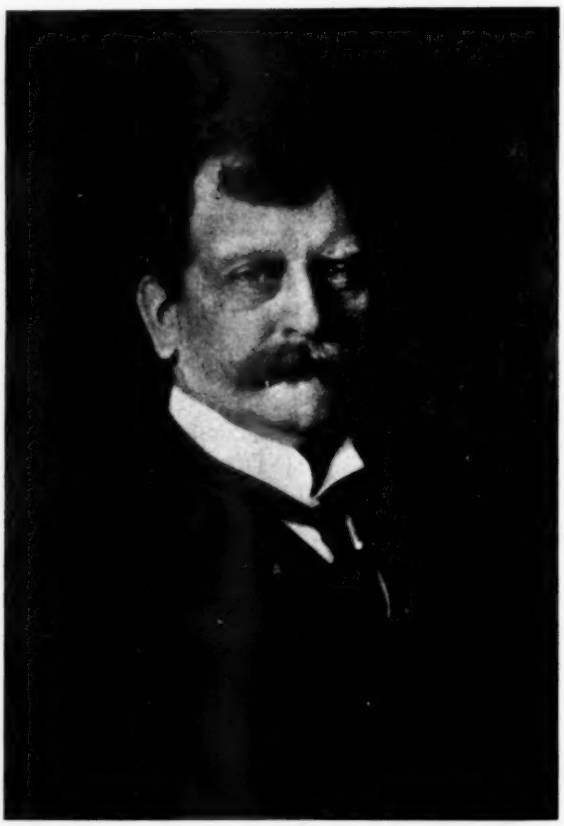
A COEXISTENT enlargement of the spleen speaks against carcinoma as the cause of an enlargement of the liver.

WHEN performing ventral suspension avoid penetrating the endometrium with the needle. An endometrioma of the abdominal wall might be produced.

THORKILD ROVSING

THE recent death of Professor Rovsing of Copenhagen has taken not only from Danish medicine, but also from the public life of Denmark, one of its most important and distinctive personalities, and from Surgery one of its most conspicuous figures.

Born in 1862, he received his medical degree in 1885. From that time until 1926, when he was forced to retire because of cardiac disease, his life was spent in actively stimulating and productive pioneer work in various fields of clinical, operative and experimental surgery. His published works number over 200 papers, including fundamental studies on cystitis, pyelography, tuberculosis of the genitourinary tract and gall-bladder diseases, and books on gastrocoloptosis, on urologic and on abdominal surgery and his collected lectures to students.



THORKILD ROVSING

He was the founder of a weekly medical journal, *Hospitalstidende*, which he finally presented to the Danish Medical Society, after he had acquired its ownership. At the age of thirty-seven, he was appointed professor of operative surgery at the University Hospital, and at forty-two was made senior surgeon at the Frederiks Hospital. One year later, due in the main to his own striving and insistence, the present Rigshospital was started.

The Danish Surgical Society numbered him as one of its charter members. He was the modest recipient of many honors in his own country and abroad. Some of our readers will remember his address on tuberculosis of the urinary tract at a meeting of the American Medical Association several years ago.

In 1922 appeared the Rovsing Festschrift as a tribute to his accomplishments in surgery and his reputation as a teacher. He was an ideal man for his subordinates to work with and under, a great stimulator and organizer, an originator in surgical endeavor.

PROGRESS IN SURGERY

Selections from Recent Literature

SHEDDEN, WILLIAM M., Boston. The results of surgical treatment of epithelioma of the lip from the Massachusetts General Hospital and the Cancer Commission of Harvard University. *Boston M. & S. J.*, Feb. 17, 1927, cxcvi, 262.

From this study Shedden concludes:

1. The "radical" neck dissection as described will give three-year cures in 76 per cent of the cases.

2. This "radical" dissection will give 42 per cent of cures even when cancer is present in the glands.

3. Metastatic cervical gland cancer can exist in absence of palpable glands. Palpable glands do not necessarily mean cancer.

4. It is most necessary to excise chronic ulcers and tumors of the lip, if there is a possibility of cancer, and to have a microscopical examination of the tissue excised.

5. Separation of the tumors into pathological groups depending on relative malignancy is apparently of distinct value as regards prognosis and choice of operation.

6. The delay between onset and admission to the hospital, and that between the visit to the doctor and admission to the hospital is too long.

7. The position of the growth on the lip should determine whether the neck dissection is to be bilateral or unilateral.

8. More neck dissections could be done on the otherwise inoperable if sufficient narcosis and local anesthesia were employed.

9. Syphilis is not commonly seen with cancer of the lip and its presence should not delay adequate operative procedures.

10. Heredity plays a minor part in this disease.

PICKERILL, H. P., New Zealand. Excision and restoration of upper lip. *Brit. J. Surg.*, Jan., 1927, xiv, 536.

Pickerill has reported instances, in a previous communication, in young men, for whom considerable restorations of lost portions of the face had been undertaken by means of tube-grafts, including the double tube-graft flap, which he originated in 1918. He now shows by a case report that such grafts are also successful in older men.

A man, aged sixty-five, was admitted with a large fungating growth of the upper lip about the size of a hen's egg. Pickerill excised the upper lip under local anesthesia. Six weeks later plastic restoration was commenced. The first stage was to form the new lip from two flaps, one from the chest for the inner surface and one from the scalp for the outer surface. The scalp flap is superimposed on the chest flap, united, and allowed to lie alongside the left ear for a fortnight. The lower end is then divided, swung across, and inserted in the prepared bed on the right and upper borders of the excision wound. At the next stage the graft is divided and the proximal end inserted into the left side of the excision wound. The scalp tube is opened out and replaced. The patient, of course, was enabled rapidly to grow a moustache.

A point of interest lies in the excellent substitute chest skin makes for mucous membrane when transferred by double tube flaps. The extraordinary thing is that if the same skin were grafted into the same area as a free graft, it would remain white and would never take on the appearance of mucous membrane.

FARR, ROBERT EMMETT, Minneapolis. Some shortcomings in the surgery of cleft lip and palate with suggestions for meeting them. *Minnesota Med.*, Feb., 1927, x, 70.

The following innovations are suggested:

1. The Brophy wiring may be done in two stages.

2. Postoperative manual stretching of the lip will relieve tension, increase redundancy and prevent its thinning out.

3. The nasal septum may be divided at its base to allow proper elevation of the nasal tip.

4 The prolabia may be used as a prolongation of the columella rather than a portion of the newly constructed lip.

5. Lip tension should be more often relieved by making incisions along the "laughing wrinkle."

6. Cleft lip may be closed in two stages.

7. The delayed-flap method of suture of the palate may be indicated in certain cases and in every case of failure to obtain union a secondary suture should be made during the second postoperative week.

Costen, James B., St. Louis. Diphtheria infection of the middle ear and mastoid. Report of two cases. *Arch. Otolaryngol.*, Feb., 1927, v, 119.

In both of the cases reported, the complete solution of the infantile mastoid structure and replacement with organized pyogenic membrane indicated an infection of long duration. In one case the clinical course of the child for a year previous to the diagnosis of diphtheria of the mastoid, and the coincidence of the mother's pharyngeal diphtheria with the beginning of the child's vague troubles, is strong evidence that the patient had carried the diphtheria as a primary infection in the middle ear space without any signs in the nose or pharynx or symptoms referable to the ear. The symptomatology of diphtheria of the middle ear is so atypical that it probably accounts for the conviction that it is a rare occurrence. Although almost every surgeon sends out a swab of the wound for culture at operation, it is not grown on special media unless requested. The extent of destruction in the middle ear and mastoid is much greater than the severity of symptoms would indicate.

Edwards, A. Tudor, England. The surgical treatment of phthisis and bronchiectasis. *Brit. M. J.*, Jan. 1, 1927, i, 9.

Thoracoscopy and cauterization of adhesions are a valuable aid to artificial pneumothorax treatment, especially in cases where cavities are prevented from collapsing by adhesions of the band-like or string-like type, not thicker than 1 cm. The number of cases is comparatively small.

Pneumolysis can be used as an independent procedure or as supplementary to other operations; it is of no use in bronchiectasis, where basal collapse is required and there is no point of counterpressure. It is most valuable for uncollapsed apical cavities following thoracoplasty for tuberculosis. Fat appears to be the ideal medium if enough can be obtained. As an independent procedure the results are not satisfactory as the collapse is too localized.

Phrenicotomy, or rather radical phrenicotomy, is of value, as an independent procedure, occasionally in the more acute forms of phthisis, where major operations are contraindicated, and in early and, on the worse side, in bilateral bronchiectasis. It is of value as a test of the activity of tuberculous disease in the so-called "better" lung previous to thoracoplasty. As a supplementary procedure it is useful in cases treated by artificial pneumothorax, either where diaphragmatic adhesions are present, or, by reducing the capacity of the hemithorax, it may prevent reopening of cavities when the lung is allowed to expand at the end of pneumothorax treatment. Supplementary to thoracoplasty, it is of much value where the compression of the major operation is found to be insufficient. Hemoptysis from basal cavities can sometimes be controlled by this operation.

Thoracoplasty offers considerable hope of amelioration or actual cure in chiefly unilateral tuberculous disease of the lung, where artificial pneumothorax treatment is impossible or unsatisfactory, and where the disease is progressing in spite of careful medical treatment. It is of use also in cases of tuberculous empyema without secondary infection. In the septic tuberculous empyemas the results are not good, but the disease is otherwise almost invariably fatal. Considerable improvement, amounting to cure in some cases, can be obtained by thoracoplasty in unilateral bronchiectasis, but this operation will not collapse the larger bronchi near the hilum, and in some cases a non-odorous mucoid sputum remains after the operation.

Pneumotomy should be reserved for localized tuberculous abscesses which are not draining well through the bronchus, and in cases in which the generalized tuberculous process appears to be inactive. In bronchiectasis it should only be used in those cases of large localized abscess formation, and not in the diffuse variety.

Bronchostomy is occasionally of great value following drainage of large abscesses; a partial plastic operation on the chest wall should be performed subsequently.

Pneumectomy appears to be almost totally contraindicated in phthisis. In bronchiectasis, although apparently the ideal procedure, it is followed at present by an almost prohibitive mortality (50 per cent). Further improvements in the technique may eventually make it the operation of choice. The more recent cautery

pneumectomy, as practiced by Graham in America, has been followed by a much lower mortality than any other lobectomy operation, and offers reasonable hope of eradication of the septic lobe.

Ballon, David H., Montreal. Primary carcinoma of the bronchus with abscess of the lung diagnosed bronchoscopically and injected with lipiodol. *Med. J. & Rec.*, Feb. 16, 1927, cxxv, 225.

A man forty-three years of age presented a clinical picture of an abscess of the lung verified by operation. A bronchoscopic examination including a lipiodol injection, performed because of persistence of symptoms, revealed a growth of the left main bronchus, which on pathological examination was reported carcinoma.

The case reported is of interest, apart from the rather rare anatomical location of a primary carcinoma diagnosed bronchoscopically, from the fact that what clinically appeared and may possibly be a pure abscess of the upper lobe of the left lung was found to be associated with primary carcinoma of the left main bronchus. Further bronchoscopic investigation including a lipiodol injection tended to indicate that the abscess formation might be of a secondary nature due possibly to a mechanical block.

Although the growth took origin from mucous membrane the abscess in the upper bronchus was not bronchiectatic, which is also a point in favor of its being a pure abscess of the lung.

Parker, Harry L., Rochester, Minn. Involvement of central nervous system secondary to primary carcinoma of lung. *Arch. Neurol. & Psychiat.*, Feb., 1927, xvii, 198.

In four cases of primary carcinoma of the lung with invasion of the brain, meninges, spine and nerve roots, the carcinoma gave few signs, and the involvement of the nervous system was the most striking feature in each case. The clinical and necropsy records in each case illustrate the great variability in the course and tendencies of the disease and the difficulties in diagnosis. The study demonstrates the necessity of a complete general physical examination in every case of disease of the central nervous system.

Abell, Irvin, Louisville, Ky. Acute pancreatitis. *J. Mich. State M. Soc.*, Feb., 1927, xxvi, 77.

Acute pancreatic necrosis, acute hemorrhagic pancreatitis and pancreatic abscess are not separate clinical entities, but represent different stages of the same process, the origin of which is not entirely clear. The rapid destruction of pancreatic tissue is due to the activation of trypsinogen within the gland itself; normally this is done by the enterokinase in the duodenum. The most logical explanation for its activation within the pancreas is that it is due to a retrograde injection of infected bile or duodenal contents through the ducts, as well as a pancreatic lymphangitis. Biliary tract infections were present in more than 50 per cent of the reported cases, in 100 per cent of the series here reported.

The areas of fat necrosis commonly seen in the peritoneum, root of mesentery, mesocolon and omentum are due to the action of ferments in the escaped pancreatic secretion.

There are no pathognomonic symptoms, pain, vomiting and collapse being the most important encountered. The physical signs will depend on the stage of the disease: in some cases the lack of symptoms and physical signs is remarkable when compared with the extent and severity of the local lesion.

Laboratory examinations are of but little aid in reaching a diagnosis; for this, reliance must be had upon the history of previous upper abdominal disease, the present symptoms and physical findings. Pain radiating from the right costal margin across the upper abdomen, tenderness following the course of the pancreas, pain and tenderness to left of midline, and the detection of a mass in the pancreatic area are beacon lights when elicited. After all it is not so important to make a correct diagnosis of acute pancreatitis as it is to make a diagnosis of an acute surgical lesion in the upper abdomen. The earlier the operation the less the destruction of the pancreas, the less the absorption of toxic proteoses, the less the peritonitis and consequently the greater the number of recoveries. The indications are to relieve tension, to stop hemorrhage, to prevent leakage and to afford drainage. Pancreatostomy with tampon and tube drains in and around the focus of pancreatic destruction will best fulfill these indications. The drainage of the gall bladder, when the

condition of the patient permits, is a worthwhile procedure.

Chamberlain, Digby, Leeds. Acute pancreatitis. *Brit. J. Surg.*, Jan., 1927, xiv, 390.

In 13 cases the treatment was drainage of the lesser sac. In these the lesser sac was opened, usually between the stomach and transverse colon, and the peritoneum covering the pancreas was incised. The pancreas was explored with the finger, and free sloughs, if present, were removed. This exploration should be very gentle, and should never be attempted with a sharp instrument, as the splenic or other vessels may be opened. A rubber drainage tube, carefully packed off from the rest of the abdomen by gauze swabs, was then put down to the anterior surface of the gland. Five of these cases died. In the remaining 5 cases operated on, in addition to drainage of the lesser sac, a tube was put into the gall bladder. It would appear that drainage of the gall bladder and lesser sac has only half the mortality of drainage of the lesser sac alone.

Nine cases of the series gave a history of recurrent attacks of abdominal pain, situated in the upper abdomen and continuing over a number of years. For two or three weeks these attacks had been more severe, and had culminated in the real acute attack. One case, which recovered, had had typhoid fever.

Post-mortem examination in 6 of the 8 cases that died showed: single cholesterol stone in 2 cases, multiple small stones in 1, no stones in 2, congested gall bladder in 1. No case showed obstruction at the ampulla of Vater. In the two other cases there was no post mortem.

Lumbar discoloration, sometimes present, is due to a digestion of the retropancreatic tissues, which, aided by gravity, extends towards the skin of the back. In one case, after operation, a fluctuating swelling appeared below the last rib on the left side, due apparently to an extension of this process. Drainage posteriorly would appear to be rational; but unfortunately the posterior relations of the pancreas are so numerous and important that a stab through them cannot be recommended as a routine procedure.

Chamberlain has worked out anatomically what he thinks is the only possible method of posterior drainage. It consists in resecting a portion of the tenth left rib in the mid-axillary line, and aims at draining the lesser sac in the region of the tail of the pancreas. He has not yet had an opportunity of employing it on a patient. Chamberlain concludes:

1. In acute pancreatitis there is an infection of the gall bladder, caused by a hemolytic streptococcus.
2. Infection travels to the pancreas by way of the lymphatics.
3. Regurgitation of bile along the pancreatic duct is prevented by a valve which guards its opening.
4. The treatment is operative.
5. Operation should consist in drainage of the lesser sac and gall bladder.
6. As the infection is streptococcal, serum therapy might be tried with advantage.

Ladd, W. E., Boston. Congenital hypertrophic pyloric stenosis. *Boston M. & S. J.*, Feb. 10, 1927, cxcvi, 211.

In a series of 197 cases taken from the Children's Hospital and Ladd's private practice, there is an 80 per cent predominance of the male. The symptoms of this disease begin commonly in the third week of life. The tumor can often be felt if a painstaking examination is made when the infant is relaxed and the stomach is emptied, either by the act of vomiting on the part of the infant, or emptied by passing a catheter into the stomach. In the earlier cases at the Children's Hospital, roentgenograms were made in most cases but in recent years this has been usually omitted for two reasons: first, because it is unnecessary, and second, that the early postoperative feedings are less apt to be retained. In borderline cases, however, Ladd still sometimes resorts to the roentgen ray and places some reliance on the picture of the blunt, rounded pyloric end of the stomach, as well as on the amount of barium passing out of it.

Ladd states, in conclusion, that the diagnosis of pyloric stenosis is usually easily made; that the treatment should be surgical on all except those with the milder type of the disease; that prolonged or unsuitable medical treatment, before the infant is sent to the hospital, is still in his clinic the most common cause of mortality; that the surgical operation of choice is pyloroplasty because of its resulting low mortality and ease of performance. Mortality from surgical accidents has been almost negligible in his clinic. The decrease in mortality is due to earlier operation and more thorough and careful preoperative and postoperative

care. The cure is permanent. The operation may be classed as one of the most gratifying in the field of surgery.

Eustermann, George B., and Beuermann, Winfred H., Rochester, Minn. Carcinoma of the stomach. Present status of diagnosis and prognosis. *J. Am. M. Ass.*, Jan. 29, 1927, lxxxviii, 295.

The traditional conception of gastric carcinoma is in need of revision in the light of present knowledge. Progress in our knowledge of the disease has come through clinical and histopathological study of ulcers coming to operation which proved to be carcinomatous, rather than from a study of the primary type in the advanced stage. The causes of delay in the earlier diagnosis and treatment are due to several factors: procrastination, the incomplete examination, failure on the part of the laity as well as of the physician to realize the gravity of dyspepsia having its onset in middle or late adult life, obsolete teaching and textbooks. There may be few symptoms or signs in certain cases, or the lesion may be well advanced before tangible symptoms occur. The symptoms are largely dependent on the site, extent and degree of motor impairment. Diagnostic teamwork makes earlier diagnosis and better prognosis possible. One patient in four has an operable lesion.

Carcinomatous ulcer, usually simulating benign ulcer, is more common than is generally supposed. Every gastric ulcer is potentially a carcinoma. Eight per cent of carcinomatous ulcers occur in patients under forty years of age. Achlorhydria is present in 4.5 per cent of chronic benign gastric ulcers in patients past middle life. The necessity for diagnostic observations and laboratory examinations, or exploratory operations, is in inverse ratio to the skill of the roentgenologist. Roentgenologic criteria of inoperability are more accurate than those of operability.

Intrinsic gastric lesions that simulate carcinoma are gastric syphilis, lymphosarcoma and benign tumor. Extrinsic lesions are carcinoma of the pancreas, carcinoma of the duodenum, and advanced disease of the gall bladder, or carcinoma of that organ. Of various constitutional diseases that may have symptoms like those of carcinoma, pernicious anemia is the most important. Important advances have been made in the preoperative preparation of patients and in anesthesia. Exclusive of direct extension or metastasis to other organs or tissues, the most unfavorable index to prognosis in general is perigastric lymphatic involvement. Fifty-two and five-tenths per cent of patients without lymphatic involvement were well and free from recurrence three years after operation. In the group with lymphatic involvement, the percentage was reduced to 18.

Hartmen, Hans, and Dock, William, San Francisco. The use of cholin in paralytic ileus. *J. Lab. & Clin. Med.*, Feb., 1927, xii, 430.

Cholin is normally present in the muscularis of the stomach, and the large and small bowels. It diffuses out of fresh strips of gut and the fluid thus obtained reestablishes contraction in old intestinal strips from which the cholin has disappeared. While cholin is not absent in the gut in cases of ileus, the intravenous administration causes a return of normal peristalsis in experimental ileus due to infection, prolonged anesthesia, or trauma.

The authors had an opportunity to use this drug in but a single case of ileus, but the immediate result was striking.

The use of cholin intravenously in paralytic ileus is justified on both a clinical and experimental basis. The action, both therapeutic and toxic is very fleeting; the rate of administration should be controlled by following the blood pressure. One-half to 1 gm. can be given in fifteen to thirty minutes and repeated if necessary at two to three hour intervals. The cholin should be kept in sealed ampules containing the approximate dose either in crystals or solution as the decomposition products are quite toxic.

Coates, Vincent, Bath, and Groves, Ernest W. Hey, Bristol. Exploratory laparotomy and appendicectomy in chronic amebic dysentery. *Brit. J. Surg.*, Jan., 1927, xiv, 518.

The possibility of a specifically infected gall bladder or appendix acting as a release station for amebae should be considered in cases of amebic dysentery not yielding to medical treatment. There is evidence that, in certain picked cases of this type, removal of such incubation centers has mitigated the course of the disease. Laparotomy is the operation of choice, and the surgeon should be given a free hand to perform cholecystostomy,

appendicostomy, or colostomy in addition to appendicectomy as occasion seems to warrant.

Three cases are reported.

Seelig, M. G., St. Louis. Fundamental principles underlying the operative cure of inguinal hernia. *J. Am. M. Ass.*, Feb. 19, 1927, lxxxviii, 529.

In children and in muscular young adults, with oblique hernias having a narrow-necked sac, one may feel a distinct sense of assurance if he has merely accomplished a high ligation of the sac. He should always, however, in addition to this, suture the outer flap of the external oblique muscle to Poupart's ligament. If the edges of the transversalis fascia are available, added assurance will attend this approximation. If the hernia is larger or if it is of the direct variety, high ligation of the sac alone is not by any means a reliable guarantee against recurrence. Here the fascia transversalis should be diligently sought for. If found, and the defect in it securely closed, the major part of the cure has been accomplished. If it is not found, then, by the use of McArthur's technique, the conjoined tendon (when present) or the lower portion of the rectus sheath and the red muscles are sutured to Poupart's ligament with a fascial strip. Under all circumstances, the inner flap of the external oblique is next sutured to Poupart's ligament with chromic gut, and the outer flap of the external oblique, when possible, is imbricated over this suture. The cord is transplanted in all cases. Sometimes it is not possible to imbricate the outer flap of the external oblique. Under such circumstances this suture is dispensed with, the skin and subcutaneous suture being closed over the cord.

If the hernia is unmanageably large or has recurred several times, it will be necessary to adopt the Gallie technique and weave the defect in the abdominal wall with numerous fascia lata strips.

Gibson, Thomas E., San Francisco. The diagnosis of adrenal tumors. *Calif. & West. Med.*, Feb., 1927, xxvi, 201.

A differential diagnosis of adrenal tumors from other growths, as well as between cortical and medullary tumors of the gland itself, can be made as a rule by their clinical manifestations. The added information gained by a urological investigation is often of decided value.

Adrenal tumors give rise to three distinct syndromes: (1) the genitosuprarenal; (2) the Hutchison; and (3) the Pepper.

The genitosuprarenal syndrome occurs only in cortical tumors (carcinoma, hyperplasia, adenoma) and is characterized in the female by virilism of pseudohermaphroditism, and in the male by precocious puberty. The sexual changes produced are always in the direction of the adult male type, irrespective of sex. The adult male shows no characteristic sexual alterations. Cortical tumors occur as frequently in infancy and childhood as in the adult.

Hypertension is frequently associated with cortical tumors.

Pigmentation occurs rarely in cortical tumors and never in medullary tumors.

The common tumor of the adrenal medulla is the neurocytoma, or "sarcoma." Medullary tumors are about as frequent in occurrence as cortical tumors. They are peculiar to infancy and childhood. Two types occur: (1) the Hutchison, characterized by early metastasis to the orbit producing unilateral exophthalmos, and (2) the Pepper, characterized by rapid abdominal enlargement due to metastasis to the liver. The primary growth generally remains small and may be discovered only at autopsy.

The prognosis in adrenal tumors is almost uniformly bad. Occasional cures are reported in cases of cortical tumors.

The treatment is surgical and roentgenological. A preliminary urological investigation is essential not only as a diagnostic measure, but to determine relative renal function, since it is often necessary to remove the kidney with the tumor mass.

Burford, C. E., St. Louis. Nephropexy for the relief of ureteral kinks associated with ptosis. *J. Am. M. Ass.*, Feb. 19, 1927, lxxxviii, 541.

The author draws the following conclusions:

1. Nephropexy is the only relief for the majority of ptosed kidneys causing ureteral kinks.

2. It is a safe operation, as the mortality is from 0 to 2 per cent.

3. Routine pyelograms and ureterograms in horizontal and upright postures are necessary to visualize the condition and make accurate diagnosis.

4. General ptosis of the abdominal viscera, kidney and ureteral stones are not contraindications for the operation.

5. Persistent infections in the ptosed kidney are frequently cured by a nephropexy which will keep the ureter straight enough to drain its contents.

Scholl, A. J., Los Angeles. Histology and mortality in tumors of the prostate, bladder, and kidney. *Calif. & West. Med.*, Feb., 1927, xxvi, 185.

The postoperative data in a series of cases of tumor of the prostate, bladder, and kidney were correlated with the histologic structure in an endeavor to establish an index of malignancy.

There are two types of prostatic carcinoma: the first type, which has a lower degree of malignancy than the second, corresponds closely to the normal or glandular structure of the prostate. The second type is made up of irregular masses of cells with no attempt at differentiation.

The common epithelial tumors of the bladder are also divided into two primary groups: the malignant papilloma and the solid carcinoma. The first group, which is made up of tumors retaining to a considerable extent the characteristics of the bladder mucosa and the benign papilloma, is of a much less degree of malignancy than the solid carcinoma group.

Tumors of the kidney are divided primarily into the papillary adenocarcinoma and the alveolar carcinoma groups. The papillary adenocarcinomas correspond to the so-called hypernephroma group and are of several different types with corresponding degrees of malignancy. The alveolar carcinoma group is a small one; the tumor, which is highly malignant, tends to reproduce the tubules of the adult kidney.

The difficulty or ease of surgical removal of tumors must be considered a most important factor in regard to prognosis regardless of the inherent malignancy of any tumor.

Pratt, J. P., Detroit. Adenomyoma or endometrial implants in the abdominal wall. *J. Mich. State M. Soc.*, Feb., 1927, xxvi, 82.

Implantation of endometrial tissue in a laparotomy scar is not uncommon. Forty-two cases are reviewed and four new cases added. It follows, more frequently, an operation in which normal endometrium has been traumatized. Ventral fixation is the most common type of operation preceding scar implantation. Special care should be used during this operation not to penetrate the endometrium. Although the growth in the scar was not encapsulated local excision was sufficient. Two cases of incomplete removal recurred. A second operation relieved both of these. All local symptoms have been relieved by removal of the growth. Regardless of the cause of other endometrial growths this group seems to be due to implantation.

Collins, Clifford U., Peoria, Ill. Adenomyomas of the rectovaginal septum. *Illinois M. J.*, Feb., 1927, li, 128.

Sampson's theory that these tumors are caused by the escape of endometrial cells through a patent fallopian tube is being generally accepted by pathologists and gynecologists.

These tumors are found only in women during the menstrual period of their lives, and the majority of the patients have not been pregnant or several years have elapsed since the birth of a child. Graves reported three cases of adenomyoma in the rectovaginal septum in which he removed the uterus with the ovaries, but did nothing to the tumor, which completely disappeared in two cases and had practically disappeared in the third case. As more cases have been reported it is generally conceded now that the complete removal of the ovaries will cause the tumors to cease to grow and will probably cause them to disappear. It would simplify the operative procedure very much if it was necessary only to remove the ovaries and leave the tumor alone, because it is very difficult to remove the tumor completely.

No examination of a tumor in the rectovaginal septum is complete unless the examining finger is passed into the rectum.

In the removal of these tumors a great deal of attention must be paid to hemostasis as these patients have a tendency to bleed freely during and after the operation.

If an accidental or deliberate opening is made in the rectum, the drainage material should not be gauze or stiff rubber, but soft rubber dam, and the rubber dam should not be placed on the suture line.

A great many more cases must be reported before definite conclusions can be made as to the proper treatment. Until definite conclusions

can be formed the treatment of each patient must be determined by the judgment of the surgeon.

Collins reports five cases.

Miles, Lee Monroe, Saint Paul. Endometrioma involving the rectum. *Minnesota Med.*, Feb., 1927, x, 88.

These two interesting cases are additional evidence of the effect of oophorectomy on endometriomatous tumors. It apparently makes little difference whether the interruption of ovarian function is secured by surgical removal or by radium inactivation.

Recurrence of symptoms is cited in two of the cases previously quoted, due without doubt to the fact that one or both ovaries had been left in place after removal of the adenomyomatous uterus. Recurrence of symptoms occurred in one of Miles' cases. The best treatment is to remove both ovaries at the time of the original operation if it is possible, but with the well-known effectiveness of radium on the ovaries good results may be obtained in those cases in which it is impossible or unwise to remove the ovaries. Extensive resections of the bowel can be avoided in most cases if the nature of the growth is recognized and the ovaries are removed or radiated.

Miles draws the conclusion that in dealing with adenomyomas that have penetrated beyond the uterine tissue and in ectopic endometriomas with numerous adhesions to adjacent organs in which it is impossible or inadvisable to remove the entire new growth, the removal of all ovarian tissue is the *sine qua non* of successful treatment.

Williams, Philip F., Philadelphia. Is the sedimentation test of practical value in gynecology? *Am. J. Obst. & Gynec.*, February, 1927, xiii, 228.

Contrary to many, Williams concludes that the sedimentation test, while simple and easy to carry out, has not seemed to be consistent in expressing the reaction of the body to the disease process or to the nature of the pathology as found at operation. A rapid sedimentation time has not been found to presage any unusual degree of postoperative morbidity. In comparison with this test the temperature curve and the study of the leucocytes remain as more stable and reliable indices for diagnosis and prognosis.

Averett, Leonard, Philadelphia. Nonspecific protein therapy in gynecology. *Am. J. Obst. & Gynec.*, February, 1927, xiii, 238.

Nonspecific proteins have a definite and valuable place as therapeutic agents in the treatment of gynecologic infections. Their judicious use will replace surgical intervention in some cases and will thereby not deprive women of the sex organs, and enable them to continue menstrual and reproductive functions.

Following the use of nonspecific proteins there develops a leucopenia, with a decrease in the polymorphonuclear leucocytes and a relative lymphocytosis. This, therefore, supports the theory that the beneficial effect derived from this method of treatment is an increased lymphogenesis and lymph flow to the region of infection.

A febrile reaction with its train of disagreeable symptoms is not considered essential in the successful use of nonspecific protein therapy as was heretofore thought necessary. A fat-free milk of low bacterial count will give good results without a reaction and with very little discomfort to the patient.

In my experience, the use of this therapeutic agent yields the best results in the acute and subacute pelvic infections; i.e., before dense adhesions have had time to develop.

The immediate effect of the injection of nonspecific proteins is the disappearance of pain and the development of a sense of well-being.

Kennedy, John P., Charlotte. Burns and their treatment. *South. Med. & Surg.*, Feb., 1927, lxxxix, 84.

In the early stage of extensive burns, it is helpful to recognize a stage of shock and a stage of toxemia. Prevention or treatment of shock resolves itself around the relief of pain and the prevention of the loss of fluids and loss of body heat. One per cent novocaine packs in normal salt solution locally with a large amount of water by mouth and conservation of heat under an electric cabinet have proven efficacious in the stage of shock.

Toxemia is due to the absorption of toxic protein products resulting from the action of heat on normal skin, and absorption may be prevented by the addition of adrenalin chloride to the wet packs or by dèbridement of burned skin or by treatment with tannic acid.

Exsanguination-transfusion may save some

apparently hopeless cases with toxemia and convulsions.

Granulating burns may be treated to advantage with mercurochrome and paraffin dressing. This treatment rapidly clears up infection, keeps down excessive granulations and promotes rapid epithelization.

Areas to be skin grafted may be prepared by a three-day treatment with paraffin which gives a smooth flat surface to which grafts readily adhere.

Hempelmann, Theodore C., St. Louis. Cerebral birth paralysis. Factors which influence prognosis and treatment. *Am. J. Dis. Child.*, Feb., 1927, xxxiii, 296.

Two hundred and thirty-eight children with spastic paralysis were examined in consultation with a neurologist and orthopedist and the following symptoms, in the order of their importance, were found to indicate a relatively bad prognosis: (a) mental deficiency, (b) progression of the disease, (c) athetosis and (d) ataxia.

The most successful treatment was found to be peripheral neurectomy of the nerves of supply to the spastic muscles, followed by carefully supervised training which aims at restoring the proper balance between the opposed muscle groups.

Smith, Millard, Boston. The use and action of o-iodoxy benzoic acid in the treatment of arthritis. *Boston M. & S. J.*, Feb. 24, 1927, cxcvi, 305.

O-iodoxy benzoic acid was introduced by Young and Youmans of the University of Michigan in the treatment of arthritis. In structure it is similar to the salicylates except that it contains iodine and readily available oxygen. Its action is similar to that of the salicylates but it is many times more effective. When first introduced, intravenous injections were used, but it has also been found to be effective orally. When given intravenously it produces a severe constitutional reaction while administration by mouth is attended with practically no discomfort. It is analgesic, relieves muscle spasm, and reduces edema. The presence of joint pain, muscle spasm or swelling should be an indication for its use. The chronicity of a joint lesion is no contraindication for a trial of the drug. A series of thirty-three patients with different types of arthritis treated with this drug is presented.

Meyerding, Henry W., Rochester, Minn. The preoperative differential diagnosis of bone tumors. *J. Am. M. Ass.*, Feb. 5, 1927, lxxxviii, 365.

Meyerding presents a classification of bone tumors in which they progress from the traumatic and infectious through the benign to the most malignant types. It consists of ten groups: 1. Inflammatory lesions simulating bone tumors (osteoperiostitis): traumatic (callous, ossifying hematoma); syphilitic; infectious (non-suppurative osteitis of Garre, Brodie's abscess, tuberculosis). 2. Osteitis fibrosa cystica; cysts. 3. Benign osteogenic tumors: exostosis; osteoma; chondroma; fibroma. 4. Giant-cell tumors. 5. Angioma. 6. Endothelioma (Ewing's tumor). 7. Periosseous fibrosarcoma. 8. Osteogenic sarcoma. 9. Multiple myeloma. 10. Metastatic tumors.

Meyerding asserts that with a history, clinical examination, urinalysis, Wassermann test and roentgenogram, an expert may accurately diagnose 9 out of 10 cases. There exists a small group, however, which defies even the most experienced until the tumor is explored and the macroscopic and microscopic character is determined; doubtless, rare examples occur in which the malignant growth is unsuspected until metastasis is evident. The roentgenogram properly made and interpreted is one of the most valuable, if not actually the most valuable aid in diagnosis, and will alone insure the diagnosis of the majority of bone lesions. Illustrative cases are cited. In discussing the preoperative differential diagnosis, the physician, roentgenologist and surgeon should cooperate. When differences of opinion exist as to diagnosis, the value of the pathological examination, both macroscopically and microscopically, should not be forgotten, as in these patients the fate of a limb is frequently dependent on them.

Wilson, John C., Los Angeles. Dislocations of the outer end of the clavicle. (Discussion.) *Calif. & West. Med.*, Jan., 1927, xxvi, 39.

Dislocation of the acromioclavicular joint, if not reduced, is a disabling condition. Fixation with an absorbable ligature and arthrodesis of the acromioclavicular joint has been common practice with an end-result of questionable value. Since the cause is a rupture of the ligamentous structures binding the clavicle to

the coracoid process of the scapula, the cure must lie in their repair or reconstruction.

Wilson has reconstructed the coracoclavicular ligament by passing a free fascia lata transplant through the distal end of the clavicle and the coracoid process, pulling it taut and securing it in position with sutures. A stable joint has been the result in four cases. The period of convalescence is comparatively short, averaging about ten to twelve weeks.

Funston, Robert V., Detroit. The treatment of fractures of the os calcis. *J. Mich. State M. Soc.*, Feb., 1927, xxvi, 102.

The important causes of latent disability in fractures of the os calcis are:

I. Irrigation of the calcaneocuboid and calcaneo-astragaloid joints by displaced fragments.

II. Lateral displacement of the fragments causing impingement on tissues and interference with tendon motion.

III. Flat foot and knock ankle deformity causing improper weight bearing.

IV. Loss of the normal length of the os calcis by impaction.

To obtain roentgenograms that will clear these points, plates must be taken in three directions: (a) anterior-posterior, (b) lateral and (c) through the os calcis from the rear at a 45° angle.

A technique has gradually been developed by Funston and Hall for all fractures of the os calcis with displacement. It consists in:

1. Allowing the patient to rest four to eight days until the swelling begins to subside, then careful preparation of the skin.

2. Open lengthening of the tendo Achillis by the sliding method. This is used as a means of avoiding the more dangerous subcutaneous tenotomy.

3. Breaking-up of impaction and reduction of displacement of the posterior fragments by use of the No. 24 urethral sound passed over the os calcis through small incisions in the skin (Cotton's method). To obtain sufficient leverage the patient is turned on his stomach and the toes allowed to reach just over the edge of the table. Counterpressure in the arch is obtained with a padded wooden board wrapped in sterile dressings and sustained against the surgeon's chest.

4. The inner side of the foot is placed against a sand bag and the fragments under the outer malleolus impacted with a mallet and rolled bandage (Cotton).

5. When the restoration seems complete a cast is carefully applied with the foot in slight inversion at a 90° angle. The rolled bandage is left carefully in place under and behind the external malleolus to prevent any recurrence of the displacement of the lateral fragments. The cast is undisturbed for four weeks when the anterior half is removed. At six weeks the feet are removed from the cast only for daily motion and heat. At eight weeks the casts are entirely removed and two weeks later weight bearing is begun in specially prepared shoes. A small outside upright of steel with an inside T-strap prevents lateral strain while a high arch support of felt prevents strain on the os calcis itself.

Ghormley, Ralph K., Boston. Heliotherapy in relation to the treatment of tuberculosis of the spine in children. *J. Am. M. Ass.*, Jan. 29, 1927, lxxxviii, 289.

Ghormley records his observations of 63 cases of tuberculosis of the spine at the New England Peabody Home for Crippled Children in Newton Center, Mass. Of the 63 patients, for the most part children under ten years of age, all but 4 had the onset of the disease before the age of six years, and in 43 of the remaining 59 cases, the disease began before three years of age.

The value of the weight chart as a guide to treatment is emphasized. The climate of New England and particularly that part around Boston is at times not mild. The yearly average percentage of possible sunshine is 57. During the months of November, December and January, about 48 per cent of possible hours of sunshine are available. From June through September, there is about 63 per cent. There is a definite tendency toward a general loss in weight during the winter months, while during the summer months a marked rise occurs.

Artificial light of the mercury vapor quartz type is now used as a substitute for sunlight on cloudy and cold days. So far, experience has not shown any striking results from this form of therapy. It seems to have a definite tonic effect in some cases and produces a distinct pigmentation. Calcification, both in the spine and in the abscesses not drained, represents a more striking change than is seen in cases treated without heliotherapy. Whether there

is a specific action of the sunlight toward this in tuberculosis has not been proved.

In a case cited, the roentgen-ray examination showed calcification throughout the lesion and gradual diminution in the size of the psoas abscess with calcification. At autopsy the spine and psoas abscess were removed. These have been sectioned and thoroughly studied. Nowhere, either in the spine or in the walls of the abscess, is there any evidence of active tuberculosis. There is healing by fibrosis, and the marrow spaces of the involved vertebrae show only the normal cellular constituents of vertebrae in a child of that age. The contents of the calcified abscess were not hard but were of the consistency and appearance of wet chalk. The spine on gross examination was firm and solidly fused over the diseased area. Ghormley feels that this case furnishes definite proof that the disease in the spine may be healed by heliotherapy.

Success in improving deformity depends on the localization and particularly the extent and duration of the disease, and early diagnosis followed by adequate treatment under constant observation will result in healing with slight, if any, deformity. Though the advantages of heliotherapy are well known, the calcification in the lesion and in the abscesses is an important change, and the altered reaction of the tissues through allergy may be better sustained under heliotherapy and thus healing favored.

Sonnenschein, H. D., New York. A modification of the Steinmann nail. *J. Am. M. Ass.*, Jan. 22, 1927, lxxxviii, 243.

The chief annoyance in using the Steinmann nail is that the nail sticks into the mallet at the end of the blow, and at the close of the operation the mallet is badly mutilated, and many times the nail also. If, as is a common practice, a flat instrument is held between the nail point and the mallet, this instrument is dented and scratched, and does not protect the end of the nail from damage.

To the usual type of nail, a "shoulder" is braised at one end; this shoulder is so placed that it does not interfere with the skin wound or with the traction pieces. A sheath of steel tubing is fashioned over this end, long enough to fit against the shoulder and to clear the end of the nail. The blows of the mallet are directed against the flat end of this sheath, and after the nail is in position the tubing is removed. The shoulder is of aid in withdrawing the nail, as it can more easily be grasped with a pair of forceps.

SUPPLEMENTARY ABSTRACTS OF ROENTGENOGRAPHY AND RADIUM THERAPY

Drueck, Charles J. Operability of cancer of the rectum. *Illinois M. J.*, August, 1926, l, 155–157.

Rectal carcinoma remains localized for long and this fact would make its radical removal a very hopeful undertaking if the growth can be discovered early. A thorough roentgen exmination is indispensable. Such an examination made by an expert presents very definitely and distinctly the filling defects by a barium mixture. The examination should be roentgenoscopic, and films should also be taken in order to determine accurately the condition and location of the lesion. By such a carefully interpreted roentgen examination, very few cancers of the pelvic bowel can escape diagnosis, while at the same time undue importance will not be given trivial deviations from the normal.

The pelvic bowel may be examined after a barium meal by mouth or with the aid of an opaque enema. The clyster is the more frequently used and in the study of obstruction of the bowel the clinician will gain valuable evidence while watching the inflowing enema. The patient lies on his back on the screen table and the opaque mixture is allowed to fill the rectal ampulla. The sigmoid flexure and the rest of the colon fill irregularly; and at this time palpatory manipulation is employed.

There are wide variations in what must be considered pictures of the normal terminal gut, *i.e.*, where junction is normal and there is no visible lesion in the rectum. The descending colon usually varies somewhat at the sigmoid flexure and expands again at the ampulla, then tapers towards the anus. The most important sign on the roentgenogram of the pelvic bowel is the filling in of defects in the contour of the bowel. This change from the normal outline may be due to spasm of the colon, to feces, intestinal gas, adhesions or extrinsic pressure on the intestine or tumor growth. In cancer, this irregularity may be sharply outlined or definitely shaded.

In the colon, obstruction other than cancerous is very rare. The filling defect shows the proximal limits of the disease. This deformity of the outline of the intestine may show a concentric narrowing of the lumen or it may be limited to one side. After a tumor has been

located, it has to be differentiated from diverticulitis, tuberculosis, actinomycosis, syphilis, and benign tumors within the colon. Spastic contractures of the sigmoid colon show as small irregular haustra. Five cases are briefly cited.

Editorial. Cholecystography. *Lancet*, July 3, 1926, ii, 25–26.

One of the finest examples of fruitful results proceeding from academic medical research is the evolution of tests for the function of the kidneys and liver which was led up to by the investigation of the pharmacology of phenolphthalein compounds. The sulphone derivative of phenolphthalein is excreted almost solely by the kidneys while the halogen compounds are excreted partly by the kidney but to a greater extent by the liver. Considering the fact that Graham's preliminary report was published only in 1924, a very considerable amount of knowledge has been collected on the subject of cholecystography, and the method although not yet standardized has become definitely established in clinical medicine.

There is no doubt that the intravenous method of administration of the dye gives better shadows and is on the whole more reliable than the oral method, but as regards safety for the patient the method of oral administration is less hazardous. The dose which can be administered by mouth is no greater than that by the veins, for if it is increased, vomiting is produced and the test is spoiled. There appear to be but few failures when the cholecystographic test is properly carried out. Even allowing for the enthusiasm for a new and ingenious procedure, the results of cholecystography reported from all quarters show such a degree of reliability that the method is certain to obtain a permanent place in diagnosis.

Eisendrath, Daniel N. The diagnosis and treatment of bladder tumors. *Illinois M. J.*, September, 1926, l, 205–210.

For practical purposes it is important to remember that about 90 per cent of all bladder tumors belong to the epithelial type. The remaining 10 per cent include benign neoplasms like fibromyoma, angioma, adenoma, and more malignant ones such as sarcoma, sarcocarcinoma, etc. About 40 to 50 per cent of the epithelial bladder tumors are simple papillomas. Bladder tumors present one or a combination of the following predominant symptoms: (1) hematuria; (2) symptoms like those of an acute or chronic cystitis; and (3) symptoms of bladder neck obstruction.

For clinical purposes of therapy, cases may be divided into: (1) those showing prospect of cure; (2) those in which cure is questionable, and (3) those in which it is hopeless, and where therapy can be only palliative. The tumors in Group 1 include the benign papilloma whether pedunculated or sessile. This can be handled effectively by fulguration with or without radon implants. About 35 per cent will recur after endovesical treatment, but even these can usually be cured by further treatment. In other cases, surgical diathermy through a suprapubic cystotomy incision is found effect tive. Diathermy gives promise of far more permanent cures in both benign and malignan- papillomas than does either radium or resection.

The cases in the second group include those of recurrent papilloma in which fulguration or radium treatment is of no avail, and also cases of papillomas which appear to be malignant from the outset. Clinicians are still groping in the dark as regards the treatment of such cases. Some prefer radium alone, others believe in resection of the tumor, while still others employ a combination of these two methods in conjunction with deep roentgen therapy and diathermy. The statistics from the various clinics are not very encouraging. The author has found that surgical diathermy applied through a suprapubic incision has thus far given the most satisfactory results in medium and large benign, as well as malignant papillomas.

The therapeutic means which can give relief to the incurable cases are deep roentgen therapy, endo- or transvesical insertion of radium, ureterostomy or nephrostomy and reimplantation of the ureters into the rectum.

Farr, Charles E. Dislocation of the carpal semilunar bone. *Ann. Surg.*, July, 1926, lxxxiv, 112–115.

During the past seven years about 20 cases of dislocation of the carpal semilunar have been observed, 12 of which were treated by closed reduction or excision of the bone. One case was seen on the day of accident and the dislocation was reduced with great ease and gave an excellent result. Late reduction or excision may give good but not perfect function. About 10 per cent of stiffness and weakness of the wrist will usually occur in late cases.

Without the use of roentgenograms only a good guess may be made, but the presence of a painful, weak, swollen wrist with a special swelling on the anterior surface and rather marked limitation in flexion with local tenderness are quite suggestive of the lesion. In the present series the correct diagnosis was made on several occasions before confirmation by the roentgenogram.

It seems reasonable to believe that most of these dislocations really start as dislocations of the os magnum backward. As the force is continued the os magnum drives the semilunar from its pocket in the carpus and itself resumes a more normal position in the wrist. This was noted repeatedly on partially successful reductions of a dislocated semilunar. The bone reaches nearly a normal position in the carpus except for its relations with the os magnum. Three cases are briefly cited.

Friedrich, H. The weakly concentrating gall-bladder in relation to cholecystography. *Deutsche Ztschr. f. Chir.*, 1926, cxcviii, 1–10.

In 27 out of 100 cases, it was not possible to obtain a gall-bladder shadow on otherwise good roentgenograms. The author employed the sodium salt of tetraiodophenolphthalein which was injected intravenously in 3–4 gm. quantities. Twenty-two of these cases were operated on and the gall-bladder was found diseased every time (histologically confirmed). Of the remaining 5 cases, 4 refused operation and the fifth was not advised operation because gall-bladder disease was not suspected. In 8 of the operated cases (4 with gallstones) none exhibited any obstruction, and there was no demonstrable hindrance to the outflow of the bile from the gall-bladder.

The color of the gall-bladder bile in roentgenologically non-demonstrated gall-bladders differed from that in the visible gall-bladder. In the visible gall-bladder the bile was dark to deep black, while in the non-visible gall-bladder it was always lighter colored (mahogany brown or olive green) if not containing whitish mucus. The latter suggests that either the liver secretes another kind of bile, or else more probably, that the bile in the gall-bladder is not concentrated in the usual manner. A determination of the bilirubin content may be used as a measure of the concentrating power of the gall-bladder.

In a series of exploratory laparotomies, the bile was removed through a fine needle from apparently healthy gall-bladders and the color in all cases was deep black with very high bilirubin values.

In the 8 cases above mentioned showing no cystic obstruction the bilirubin content of the bile was very low. This is regarded as clear indication that the gall-bladder mucosa has lost its concentrating power, and this is also the reason why the tetraiodophenolphthalein failed to concentrate sufficiently to a cast a shadow in the roentgenogram. The particularly important point established is that a gall-bladder may show hardly any external changes at operation, may appear perfectly normal, and yet may fail to give a roentgen picture owing to its inadequate functioning. Two examples are cited.

These observations may perhaps throw light upon certain obscure gall-bladder diseases. These are the atypical conditions described under such various names as pericholecystitis, periduodenitis, gall-bladder inflammation without stone, and mechanical cholecystitis. This is a field in which cholecystography may very well contribute important results. In the absence of cholecystography, puncture of the gall-bladder and examination of the bile will disclose the existence of a poorly concentrating gall-bladder. Such a finding would justify the removal of the gall-bladder. It still remains to be seen what the end effects will be in cases where such a gall-bladder has been removed.

Grauhan, Max. The diagnosis of cystic kidney. *Deutsche Ztschr. f. Chir.*, 1926, cxcvii, 205–231.

A functional test of the cystic kidney is indispensable in determining the stage of the disease and in establishing the prognosis in the individual case. The functional test is, however, not sufficient to establish the diagnosis where the palpatory findings are indefinite, because the results in early cases of polycystic degeneration deviate only slightly from the normal. The combined clinical, functional and roentgenological examination of cystic kidney permits a fairly accurate understanding of the condition and functional activity of both kidneys before operation. This has the advantage that a choice of suitable treatment can be made judiciously. There is no longer any need for a quick decision such as is necessary at the time of operation.

The age of forty to sixty years appears to be the most dangerous for those affected with cystic kidneys. Experience shows that the greatest danger is not from hemorrhage and infection but from uremia. Pyelography and pneumography are very important procedures in diagnosis. It appears that German authors have not fully appreciated the advantages of pyelography in the diagnosis of cystic kidney. Pathognomonic pictures by pyelography can be expected only if the calyx undergoes characteristic change during cystic degeneration. This is not yet certain for those cases in which the degenerative process is only recent.

Herrick, Frederick C. Pyelography in the diagnosis of tumors of the flank. *Ann. Surg.*, May, 1926, lxxxiii, 634–650.

Tumor masses occurring in the flank, i.e., that area bounded by the ribs, iliac crest and linea semilunaris, often present many difficulties of diagnosis. The history, clinical signs

and results of general and local physical examination may be inconclusive, and the urologist may be sought for special evidence.

In such cases the author has made use of the device of placing a coin on the surface over the tumor and then making a pyelographic examination. This has enabled the differentiation of intraperitoneal from retroperitoneal masses (perirenal, subrenal and renal); (2) extrarenal (retroperitoneal) from intrarenal masses; and (3) intrarenal masses.

In making these differentiations use has been made of six factors as observed in the roentgenogram: (1) the position of the kidney; the normal being with its pelvis opposite the first or second lumbar intervertebral space. Variation from this must be explained by hypermobility due to one of the known causes, or displacement by tumor masses or drawing as by inflammatory processes. (2) Disturbances of the normal longitudinal renal axis. The normal direction is obliquely toward the spine cephalad, at an angle of 15°. (3) Disturbance of the normal anteroposterior axis or rotation of the kidney on its vessels as an axis. (4) Distortion of one or more calyces of the pelvis; typically seen as when caused by pressure on the kidney from an extrarenal mass. The entire pelvis and calyces are present but elongated or distorted by pressure. (5) Absence of a part or all of one or more calyces. This, in the author's experience, has been brought about most commonly by intrarenal masses, abscess or tumor, by which a calyx has been distorted or obliterated by pressure so that the contrast solution does not enter it. (6) Fragmentation of the pelvis or calyces which constitutes a typical picture of tumor close to the true renal pelvis.

Tumor outside the kidney is more likely to change the renal axis and distort the pelvis or calyces; while tumor within the kidney is more likely to obliterate or fragment the calyces. Twelve illustrative cases are cited and pictured.

Higgins, C. C. Chronic duodenal ileus. *Arch. Surg.*, July, 1926, xiii, 1–42.

Chronic duodenal ileus is not a rare condition and there are undoubtedly many cases that have not been diagnosed. Because of the severe headache associated with this condition a diagnosis of migraine is usually made. In all cases of severe headache associated with vomiting, a careful examination of the duodenum should always be made. Sometimes an accurate diagnosis is not made until the duodenum is exposed during an exploratory operation. Even the roentgenogram may not clearly define the condition.

The history and physical findings are important, as has been shown by the fact that in a few of the author's cases a correct diagnosis was made before the roentgen examination. However roentgenographic and roentgenoscopic examinations are of considerable value in many cases. Sometimes evidences of antiperistalsis, regurgitation of the barium meal into the stomach or of duodenal stasis may be secured roentgenoscopically while only a questionable roentgenogram is obtained. It should be realized that a pathologic condition may be present in the duodenum even if the duodenal cap fills perfectly. To eliminate duodenal stasis the duodenum should be observed at intervals for a period of from twenty to forty-five minutes. In many instances an enteroptosis or gastroptosis renders visualization of the third portion of the duodenum difficult, and a lateral view must be taken to secure a good picture.

Obstruction of the second portion is more readily visualized as the dilatation is frequently above the transverse colon and can be seen to the right of the stomach. Delay in the passage of barium through the duodenum is suggestive especially if the duodenum is constantly visible. Hayes' technique for visualization of the duodenum should be used in suspected cases. Of course in all cases of acute dilatation of the stomach the condition should be suspected, and an attempt should be made to see whether change of posture will relieve the symptoms.

In cases in which the dilatation is insufficient to produce duodenal stasis and is associated with gastroptosis, an effort should be made to secure relief by non-operative measures. If the dilatation is marked and stasis with antiperistalsis is present, a duodenojejunostomy should be performed with the expectation of satisfactory results. Resection of the right colon is indicated in a few cases and should be performed only as a last resort. Gastroenterostomy should not be performed as the stasis in the duodenum is not relieved, and a vicious circle is established.

The author gives case reports of 57 patients, 31 of whom received medical treatment, 3 medical and surgical, and 20 surgical. The 3 remaining cases were diagnosed only.

Hubeny, M. J. The *X*-ray in appendicitis. *Illinois M. J.*, September, 1926, l, 235–236.

Because the appendix may have a physiological function, it should be studied roentgenologically before removal in suspected chronic cases. Because it possesses peristalsis, an appendix showing in the roentgenogram either retention or rapid expulsion of the barium

is of diagnostic value. Because of its reflex influence over the alimentary tract, the appendix should be investigated by the barium method in many diseases of the stomach and intestines. The location of the appendix can be determined approximately even when not visible on the plate or screen because of the anatomical relation to the cecum. When barium-filled, the appendix can be studied roentgenoscopically in great detail and accurately palpated for pressure pain and adhesions. The time of examination is important, for the appendix commences to fill shortly after the cecum.

Madlener, Max. Tuberculosis of the os pubis. *Deutsche Ztschr. f. Chir.*, 1926, cxcvi, 329–335.

Tuberculosis of the os pubis is a very rare condition and the author's experience shows that if there is prolonged fistulation in this region, suspicion of tuberculosis may be entertained, and a pelvic roentgenogram will confirm the diagnosis. This disease has been reported in the literature in 33 cases and the author adds 5 more which have been observed in the past two years.

In the author's cases the local roentgenogram showed in the region of the fistula a washed out appearance of the bony structure, (rarefied), the vicinity of the foci showed no sclerosing processes but rather partial atrophy, and the periosteum disclosed no stratification. Other manifest tuberculous foci in addition to the involved os pubis were found 3 times.

The treatment consisted of strict rest in bed and nourishing diet, local roentgen irradiations and sun baths of the whole body. Some of the cases required operative treatment. The question as to whether conservative treatment will suffice or not depends on the nature of the individual case. The prognosis so far as the local condition is concerned is favorable.

Marietta, S. U. Abscess of the lung. *Am. Rev. Tuberc.*, August, 1926, xiv, 107–134.

The diagnosis of abscess of the lung is one of elimination. The history is of great importance. Any failure of resolution or clearing up of the pulmonary tissue following an infectious disease therein (lobar pneumonia, bronchopneumonia, influenza, etc.), symptoms indicating localized pulmonary involvement after a general anesthetic especially when given for operative procedures on the upper respiratory tract, or the presence of non-suppurative processes elsewhere in the body should always cause one to think of lung abscess.

The roentgen ray is of great value in the diagnosis and it is absolutely necessary for the definite localization of a pulmonary abscess. Thickened pleura, if marked, or a prominent area of pneumonic reaction about an abscess may vitiate the information to be obtained roentgenographically. The plates should be stereoscopic, and as the definite localization of the condition may be the deciding factor in the method of treatment to be followed, it is advisable to take both anteroposterior and lateral views. It has been stated that the judicious use of sedatives for twenty-four to forty-eight hours preceding roentgen examination is helpful, as there is an accumulation of secretion and thus exaggeration of the signs. The physical signs are not very characteristic, only serving, as a rule, to show the presence of the localized area of involvement in the lung. The use of the bronchoscope had best be left to those special clinics where an expert in its use is present. The diagnosis of lung abscess necessitates a differential diagnosis from bronchiectasis, gangrene, encysted empyema, pulmonary tuberculosis and lung tumors. In all of these the roentgenogram is of great assistance.

The author has observed in the hospital at Fort Sam Houston 15 cases of single and 2 of multiple lung abscess. The etiology in one case was extension from an amebic liver abscess, in 6 lobar pneumonia, in one the abscess followed tonsillectomy, and in one bronchopneumonia; in 8 the etiology was undetermined. The infecting organisms were streptococci in 3 cases, pneumococci in 4 cases, mixed streptococci and staphylococci in 3 and unknown in 7. Only 6 of the cases, all with single abscesses, were chronic, the rest being acute. Of the 17 cases, 7 were cured, 2 improved, one unchanged and 2 remaining in the hospital. There were 5 deaths (including the 2 cases of multiple abscess).

Six of the cases are reported, one or more of the serial roentgenograms being presented in each case as illustrative of certain pathological types or of changes taking place under treatment.

Monari, Augusto. A post-traumatic cerebral pneumoventricle. *Radiol. med.*, July, 1926, xiii, 492–494.

A boy of ten was injured in an automobile accident and brought as an emergency case to the hospital with signs of concussion of the brain. He presented a fracture of the vault and base of the skull and a large scalp wound. Roentgen examination showed fracture of the temporal and parietal bones, and the presence in the midst of the cerebrum of two transparent zones the form of the cavity of the lateral ventricles, showing that air had entered these ventricles. As to the portal of entry and the route which the air had taken to enter the ventricles, the author concludes that the air

entered through the scalp wound and the fracture of the skull into the subarachnoid spaces and then passed into the fourth ventricle by the foramina of Magendie and Luschka, and finally reached the lateral ventricles through the Sylvian aqueduct, the third ventricle and the foramen of Monro. The case ended favorably and the patient left the hospital at the end of two months completely cured.

NAEGELI, TH. The significance of the roentgen picture in the diagnosis, therapeutic indications and the evaluation of the result in surgical tuberculosis. *Strablentherapie*, 1926, xxi, 342–352.

This is a general lecture giving an outline of the relation between the pathology and the roentgen findings in surgical tuberculosis, and suggesting the general principles that guide in the treatment of suitable cases.

As regards diagnosis, the most important item is the recognition of the type of tuberculosis present. In the fibrocirrhotic and cavernous forms which from their nature have a healing tendency, the aim should be to support and augment this tendency. The exudative form which is prognostically more unfavorable is, on the other hand, only rarely suitable for surgical treatment. The roentgenogram permits a differential diagnosis of certain lung conditions that may resemble tuberculosis.

An extensive roentgenological experience combined with a knowledge of the pathologic anatomical factors is necessary to enable one to make use of the roentgenological findings in the selection of cases of pulmonary and bone tuberculosis for surgical treatment.

Repeated irradiations of tuberculous tissue may lead to undesirable effects. This, however, is minimized under present conditions of roentgen technique.

NEUSWANGER, C. H. Iodized oil as a pyelographic medium. *Surg., Gynec. & Obst.*, August, 1926, xliii, 169–176.

The iodized oil used was an emulsion of 90 parts of iodipin (40 per cent, Merck) with 10 parts of neutral soap solution. The soap solution was added because it was found that the original solution flowed with some difficulty through small ureteral catheters. The slight decrease in the opacity of the emulsion was found to be negligible.

The iodized oil was used upon a series of laboratory animals as a pyelographic medium giving excellent results and giving no evidence of toxicity or irritation in the urinary tract. When injected into the venous circulation in dogs in large amounts, it was found to cause areas of temporary congestion with hemorrhage and infiltration of the lung alveoli; but animals observed for a period of two months showed no untoward symptoms. The iodized oil was found to possess no appreciable bactericidal or bacteriostatic action.

In the clinic, very satisfactory ureterographic and pyelographic shadows were obtained when the emulsion of iodized oil was used. This was true in 2 cases when previous pyelograms and ureterograms made after the injection of 12.5 per cent sodium iodide failed to cast a shadow sufficient for diagnosis.

Iodized oil was found to be especially useful in obese patients and even a small injection of 1 to 2 c.c. into the ureter gave a very dense shadow. Ureteral injections were found to be more complete with iodized oil than with sodium iodide in several instances in which a direct comparison was made.

The oil was found to escape readily from the urinary tract and a roentgen examination twelve hours following an injection gave no evidence of residual oil within the renal pelvis or ureter.

The iodized oil was employed with good results in a series of 27 cases in the Department of Surgery, Yale School of Medicine. Some of the patients examined had had marked destruction of renal tissue, but the oil injections were borne without symptoms of irritation or evidence of harmful effects upon the diseased kidney. Five cases are briefly described and illustrated.

NEWELL, QUITMAN U. The use of iodinized oil (iodipin) as a diagnostic aid in gynecology. *Am. J. Obst. & Gynec.*, August, 1926, xii, 189–199.

The author, summarizing his personal experience to date, states that iodipin injections will prove of diagnostic value (1) in sterility cases where the tubes are found obstructed, to determine the character and location of the obstruction. It offers the opportunity of deciding definitely whether or not the case is suitable for operation. (2) When several masses are palpable within the pelvis, injection and roentgen study will clearly differentiate the uterus from the other masses. (3) In cases in which the pelvis is blocked by one large mass. By this method, the precise diagnosis can be made as to whether the tumor originates from the ovary or the uterus. (4) In cases in which a foreign body is suspected within or outside the uterine cavity.

Iodipin injections into the uterus prove helpful in differentiating chronic appendicitis from a right sided salpingitis, and a tuberculous salpingitis from common salpingitis, which means that they might possibly enable one to

make a definite diagnosis of a tuberculous tube.

The method is an invaluable aid in indicating the size of the uterus and determining whether the cavity is encroached upon by any masses such as a fibromyoma, a carcinoma of the fundus, etc. Iodipin injections carefully and skillfully done are not likely to be harmful to the patient.

In 38 cases injected in the course of three months the author has not observed a single unfavorable reaction. There was occasion to open the abdomen of 30 of these cases at various intervals from one to fourteen days after the injections, and no irritating effects were seen of the iodized oil on the tissue of the pelvis in cases where it had passed through the tubes. It would seem that the oil is ultimately eliminated. The exact time of the disappearance of the oil from the pelvis has not been ascertained, but it appears certain that the absorption is relatively rapid and is not a matter of months as in the case of injections into the spinal canal.

Nicolson, William P., Jr. Gastric carcinoma with report of three cases of apparent cure. *J. Med. Ass. Georgia*, July, 1926, xv, 272–276.

An early and thorough roentgen examination should be made in all cases of suspected gastric malignancy. In cases where there is definite evidence of metastasis or where the general condition of the patient is poor or where roentgen examination shows extensive involvement about the cardiac end, exploratory operation is probably not advisable; but in practically all other cases it is and the sooner performed the better. The mortality from a simple exploration is exceedingly low. Radical resection of the stomach is the operation of choice when possible. In selected cases if operated on early and given postoperative roentgen treatment the chances for cure seem good.

Three cases are reported. The first is a case of a man aged thirty-nine who was operated on in 1912 and is living and well at the present time. The second was in a man aged sixty-two who is now living more than five years after operative removal of a definitely proven adenocarcinoma of the stomach. The third case occurred in a woman aged sixty-two who was operated on for an early carcinoma of the stomach and is living more than three years after operation with no evidence of a recurrence.

Perona, Pietro. Anomalies of the ribs and their importance in the roentgen examination of the respiratory tract. *Radiol. med.*, July, 1926, xiii, 465–486.

During the past year Perona has made a systematic search for anomalies of the ribs in the patients sent to him for examination of the chest for the purpose of determining the importance of some of these anomalies in diagnosis of diseases of the lungs. His statistics cover 1352 subjects in whom a complete roentgen examination was made. He finds that there are certain anomalies in the number of the ribs, cervical or supernumerary ribs, and that these occur in about 10 cases out of 1000, while anomalies of form occur in about 12 out of a thousand. Anomalies in the number of ribs are found in two-thirds of the cases in women, while nine-tenths of the cases of anomaly of form are found in men, and in the majority of cases on the right side. There is no explanation of this difference in any of the theories as to the etiology of these anomalies.

The number of ribs may be increased or decreased; if there is a decrease it is at the expense of the 12th rib which is fused with the 12th dorsal vertebra and transformed into a mere costiform process. No cases of disappearance of the 1st rib have been reported, although it is sometimes found in a rudimentary form. But a supernumerary rib may precede the first or follow the 12th rib. Only two of his cases with a supernumerary first rib showed any clinical symptoms, although they included all the forms of Gruber's classification. These two patients had pain in the region of the apex which he thinks was due to irritation from the floating anterior end of the rib. One of them said that the pain was always worse in the spring when his upper respiratory tract was congested. The end of a floating supernumerary first rib may be projected on the clear apex space and as it moves synchronously with the apex when the patient breathes deeply or coughs it may be taken for a shadow in the apex. A fixed first cervical rib only barely touches the edge of the apical space, and so is not apt to lead to a mistaken diagnosis, but, on the other hand, it is apt to be overlooked altogether, especially on roentgenoscopic examination. A roentgenographic examination should always be made to determine the relation of these supernumerary ribs to the first true rib and to the vertebrae.

Anomalies of form almost always affect the anterior end of the rib and may very readily be mistaken for lung shadows, particularly when they lie near the hilus where it is harder to differentiate shadows. The first rib may be fused with the second, or cartilage or a mere ligament may be substituted for the central part of it, only the vertebral and sternal parts being made up of compact bone. In the latter cases there may be pain, limited to the cartilaginous portion of the rib and generally due to the patient's occupation. The one patient of this type that the author had was

accustomed to carrying heavy loads on his shoulders and when he stopped work the pain disappeared. The most common anomaly of the other ribs is a bifurcation of the anterior end of one rib, accompanied generally by defective development of the adjacent ribs. This anomaly is found chiefly in the 3d, 4th and 5th ribs of the right side.

The various anomalies are illustrated by roentgenograms.

Philips, Herman B. Paget's disease. *J. Bone & Joint Surg.*, July, 1926, viii, 643–650.

Paget's disease manifests itself with definite roentgenological characteristics permitting a definite diagnosis whether the disease is local or general. The latter part of this statement would be probably more exact by qualifying it as early or late. General roentgen examinations are advisable in all cases of suspected Paget's disease for the purpose of accumulating data on the relative incidence of the bones involved and for the elaboration of diagnostic information. Characteristic changes in the pelvis are frequent and permit a definite diagnosis in the absence of skull manifestations.

When the involvement is early, faint striations are usually seen in the ischium or pubes. Subsequently the ilia become involved. When the disease is still further advanced marked bowing deformities of the pelvic walls occur with marked protrusion of the acetabula into the pelvis producing the characteristic Otto-Chroback deformity. Frequently, the pelvis is involved to such an extent as to be the basis for a positive diagnosis when the skull may show no changes whatsoever. This has been observed at least six times in the author's experience.

Randall, Lawrence M. Lipiodol as an adjunct to tubal inflation in the diagnosis of sterility. *Am. J. Obst. & Gynec.*, September, 1926, xii, 326–331.

Lipiodol offers a further means of accurately diagnosing tubal obstruction and stenosis as a cause of sterility in women. After tubal inflation has shown non-patency or stenosis of the tube, the site of closure or stenosis can be accurately detected with lipiodol. This information is of value in considering the advisability of surgical intervention in an otherwise normal pelvis. Such tubes are always symptomless and frequently unaccompanied by other pelvic lesions, hence there would be no other indication for operation.

As a rule, women who consult physicians primarily because of sterility are otherwise normal, and it is not justifiable to subject them to surgical operation without the benefit of as accurate a diagnosis as possible. Uncomplicated tubal occlusion is a frequent cause of sterility and the question of laparotomy is often brought up by the patient. If the site of closure can be located, one can much better judge the value of operation in a given case. Should the obstruction be in the narrowed portion of the tube, the prospect of success from a plastic operation of the tube will not be good. With pathologic change at the fimbriated end, which is relatively common, and the lumen patent to this point, operation may be justifiable. It carries with it a fair chance of success provided other conditions are normal. Three illustrative cases are cited.

The technique of injecting the lipiodol is simple and involves no special apparatus. Ten cubic centimeters of the oil is sufficient for an ordinary case, and often 5 to 7 c.c. is enough. The injection is practically painless, the technique demanding the same care that is used in transuterine inflation of the tubes by the method of Rubin.

Schiessl, M. Fractures of the transverse process of the spine. *Deutsche Ztschr. f. Chir.*, 1926, cxcvi, 297–306.

Recognition of this form of fracture was rare before the advent of roentgen rays. Roentgenograms show that fractures of the transverse process are often associated with fractures of the vertebral bodies. Isolated fractures of the transverse process have been described only recently as occurring exclusively in the lumbar spine. The author has had good opportunity to observe a number of cases in a mining community in Alsace. The material confirms the fact that most of the fractures occur in the lumbar region, but he has observed 2 cases in which the fracture of a transverse process occurred in the thoracic spine.

A total of 23 cases of isolated fractures of the transverse process of the lumbar spine was observed from 1919 to 1925 and these are briefly cited.

There is no distinctive symptom-complex associated with these fractures. The local pressure pain, blood effusion and restricted motion, are also present in contusions and distortions without involvement of the bone. The degree of disability is extraordinarily variable, and frequently patients walked to the doctor's office for examination. The precise recognition of the condition can be made roentgenographically. It is nowadays absolutely necessary to subject to roentgen examination all cases with local pressure pain in the region of the lumbar spine. As a result, many cases of lumbago, contusion and distortion become unmasked and are shown to be transverse fractures. In

the roentgenogram, the true fracture shows itself by the presence of distinct diastases in the transverse process, or at least fracture lines with displacement of the fragments toward each other. To regard linear shadows or thickenings as old fractures is not always justifiable where epiphyseal lines are present since it has been shown that the transverse processes of the first lumbar vertebra can retain these epiphyseal lines even after the individual has attained the age of twenty-five. Characteristic for the isolated transverse fractures in the lumbar vertebrae is their unilateral occurrence. Only 2 of the author's cases showed bilateral fractures. The treatment is immobilization, and the end results are good. In only one case was the occupational activity of the patient limited as a result of the fracture.

Scott, S. Gilbert. Secondary jejunal ulcers and their radiological diagnosis. *Lancet*, July 31, 1926, ii, 222–224.

Primary jejunal ulcers, that is, those ulcers which form primarily in the jejunum, not secondary as the result of a gastroenterostomy, are extremely rare. Secondary jejunal ulcers, however, are a serious drawback to the otherwise valuable operation of gastroenterostomy for gastric ulcer. As in gastric work, roentgenograms alone are of little diagnostic value, because most jejunal ulcers are extremely difficult to record on a roentgenogram even after they have been located on the screen. Under present conditions roentgenologists should not give a diagnosis of an organic lesion of the intestinal tract unless the lesion has been visualized on the screen. The hand and eye properly trained are of greater diagnostic value than roentgenograms, and direct evidence of *gastric* lesions in nearly 100 per cent of cases is believed possible in the near future if this fundamental fact is thoroughly grasped and recognized.

The roentgenologist in the course of his gastric work examines many cases where symptoms point to ulceration of the jejunum after gastroenterostomy, but such ulceration is probably seldom detected. The large majority of these ulcers can however be located accurately. The method to be followed is based on the same principle as that used in gastric work, that is, systematic roentgenoscopic palpation. It takes time and perseverance to become proficient in the art of palpation.

The main features of the method are as follows: A meal of creamy consistency is used and only a small quantity (3 oz.) of this is administered at first. This is important as a full meal of 6 to 7 oz. will defeat one's object. By means of pressure of the hands on the abdomen the opaque substance comes under full control. It is then possible to smear the cream over each section of the mucous membrane systematically. This procedure is termed by the author as "whitewashing" the interior of the stomach. The systematic examination of the whole stomach and duodenum must be emphasized, that is the whitewashing process must start at the cardiac end working down inch by inch and ending at the jejunum.

Willis, T. A. Pott's abscess. *Surg., Gynec. & Obst.*, September, 1926, xliii, 285–292.

A detailed study was made of 4 tuberculous vertebral columns from cases having no known history of syphilis or gross evidence of this disease. Roentgenograms of the cadavers showed cold abscesses of the vertebral columns at the cervical, upper thoracic, thoracicolumbar, and lower lumbar areas; also of the manubrium sterni. These findings indicate the possibility of multiple lesions in Pott's disease with consequent necessity of a thorough roentgen examination to disclose them. There was also evidence of productive changes in the bone in active tuberculosis, as well as in old healed specimens. The frequency of involvement of articular and muscular processes in addition to the vertebral bodies is also noted. Even in extensive lesions there was a notable absence of angulation or other deformity. The coexistence of extensive lesions with merely superficial erosion of the bone is emphasized.

There was also observed great frequency of abscess formation and the subdivision of the abscess into successive pockets effectually shut off from the thoracic and abdominal cavities but open dorsally between the transverse processes and ribs. There is clinically a fixation of the abscess walls to the middle of the vertebral bodies, and not to the intervertebral discs as would be suggested by the anatomical descriptions of the anterior common ligament.

Martius, Heinrich. The radiation treatment of adnexal tuberculosis in the female. *Strahlentherapie*, 1926, xxi, 260–265.

There is a definite field of usefulness in the treatment of tuberculosis of the female genital adnexa with mild doses of roentgen rays. This, however, does not exclude surgery as the method of choice in those cases in which the disease has not advanced too far. All cases which are clearly diagnosed as genital tuberculosis, even when offering the possibility of local and general operability, are no longer from the standpoint of experience, suitable for surgical treatment. An energetic attempt should be made to control the disease in these cases with roentgen rays supported by the usual conservative medical measures.

There can be no doubt that it is more desirable to avoid an operative removal of tuberculous genital organs in cases in which there are extensive adhesions to the intestines, because of the danger of producing fistulas. In such cases all one can do is to remove ascitic fluid and depend upon the action of roentgen rays.

There is a further field for roentgen therapy in postoperative irradiation of all operated cases, especially those with fistulas. In this field the reports on the effects of roentgen therapy are encouraging.

The technique of irradiation, direct or postoperative, is as follows: The lower abdominal region is exposed in a large field bounded above by the level of the umbilicus, below by the symphysis pubis and laterally by the anterior superior iliac crests. This area is irradiated at a focal distance of 35 cm., through 1 mm. Zn plus 1 mm. Al, with direct current of 6.5 mm. spark gap between large spheres. This field receives an incident primary irradiation of 150 R, *i.e.*, 25 per cent of the average erythema dose of 600 R. This irradiation requires 12 min. when 4 ma. are used. Three irradiations are given at intervals of eight days. The number of treatments is dependent upon the results obtained. In general, a series such as the above may be repeated at intervals of eight to twelve weeks. In cases of concurrent peritoneal tuberculosis, the abdominal field is extended above the umbilicus. This radiation therapy is safely within the roentgen castration dose.

Moschcowitz, Alexis V., Colp, Ralph, and Klingenstein, Percy. Late results after amputation of the breast for carcinoma. *Ann. Surg.*, August, 1926, lxxxiv, 174–184.

The follow-up results three years after amputation of the breast are not considered as of great value, and even the results after five years cannot be considered as absolutely conclusive, since too many patients die after this period from recurrences or metastases.

For all practical purposes the fate of the patient is sealed at the time of the operation. The prognosis depends upon three factors: (1) the local extent of the process; (2) the presence of distant metastases, and (3) the care with which the operation is done. The modern operation is usually successful in eradicating the local process, as is evidenced by the very large number of cases dying from distant metastases without even a suspicion of recurrence at the site of operation. The late results of the operation are not as favorable as one might be led to believe from a cursory examination. At the present writing the surgeon is practically powerless in the presence of distant metastases.

The above are the conclusions drawn from a review of cases of breast carcinoma admitted at the Mt. Sinai Hospital, New York, from Jan. 1, 1915, to Dec. 31, 1924. There were 374 patients, in 218 of whom there were available complete reports suitable for analysis.

Since prophylactic roentgen irradiation was employed in only 6 of the patients, it is impossible to state accurately the benefits of preoperative irradiation. At the present time postoperative irradiation is employed almost as a routine measure, but recurrences have been observed to begin and increase in areas most intensively treated. A number of patients who are now alive and well and who are included in the follow-up statistics have received the benefits of postoperative irradiation. How much this has influenced longevity is conjectural.

Laquerrière and Delherm. High frequency currents in the treatment of circulatory disturbances, *J. de radiol. et d'électrol., Par.*, July, 1926, x, 294–299.

Excellent results have been reported by many authors, especially American ones, from the thoracic application of diathermia in general diseases of the circulation but the authors of this article believe that while the various methods of application of high frequency currents may improve the functional symptoms they do not have any great effect on a constant hypertension nor on the hardened articles in arteriosclerosis. The conditions in which they have found diathermia extremely useful are local conditions, such as frost-bite, Raynaud's disease, obliterating arteritis and diabetic gangrene.